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PROJECT APOLLO

TASK MSC/TRW A-162

LAUNCH ABORT DATA PROCESSING MANUAL

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CONTENTS

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ILLUSTRATIONS

ILLUSTRATIONS (Continued)

1. INTRODUCTION

This report is a user's manual for the launch abort data processing software developed under MSC/TRW Task A-162 (Reference 1). It includes input definition for the PNCH08 Data Extraction Program and the Report Generator Program which supersedes References 2, 3, and 4 Modifications to the TRW Plot (TRWPLT) Program are not included in this document. Reference 5 includes all the necessary information and should be consulted when examining the examples of the TRWPLT input shown in this report.

Also presented in this report is a discussion of the general method of obtaining publishable data through the use of the launch abort data processing software.

2 VERSION 3 OF THE PNCH08 DATA EXTRACTION PROGRAM

Version 3 of the PNCH08 program is capable of extracting 100 quantities from user-specified records on a MSFC trajectory tape Nominally, the PNCH08 program is preset to extract and convert the same 21 parameters that were preset in version 2 of the PNCH08 program (Reference 3) In addition to the 21 preset parameters, the option is available to internally compute nine additional variables from these preset parameters

There are three types of output the program can provide The user may select any one, or all three of the following

a) Punched state vector cards in a format compatible with the Apollo Reference Mission Program (ARMP) or punched cards containing any launch parameters available to the PNCH08 program in any user specified format

b) Standard printed output listing or user specified tabular listing

c) Tape output for use with the TRWPLT program

Since the 9 additional parameters that are computed by the program use a number of the 21 nominal parameters internally, the user must use caution when requesting other variables than the nominal 21 specified to insure that the variables required to compute the 9 additional numbers are available

An additional feature of the PNCH08 program is a parameter reasonableness test. Each data point extracted from the MSFC tape is compared to preset upper and lower limits This capability was implemented to eliminate the possiblility of grossly erroneous data being transferred to the punched cards or input plotting tape.

A processor called MERGE has been included on the PNCH08 program tape Its function is to combine any previously generated plot tapes onto one tape so that multiple trace graphs may be generated by the TRWPLT program

2.1 PROGRAM DESCRIPTION

The PNCH08 program is written in FORTRAN V for use on the UNIVAC 1108 computer   The MSFC trajectory data tape is mounted on a user-specified tape drive unit, and the data on the tape are read into a buffer one record at a time   If the negative numbers are not stored as complements on the MSFC data tape, they are converted for compatibility with the 1108 system. The data tape is then scanned until a time is found equal to or greater than the time specified to begin processing. The user-specified data words are then transferred from the buffer to an array Each data word is multiplied, summed with the specified multiplication and addition factors, and checked to see if it is within the specified bounds If the data word is not within bounds, it is replaced by the previous corresponding data word and an appropriate message is printed

PNCH08 has the capability to internally calculate nine additional launch trajectory parameters. The nine quantities that are calculated upon request are listed below   Each parameter is accompanied by a mathematical description of its calculation. In some instances, where the mathematical description is extensive, the user is directed to the reference provided. The user may not change the output location or calculation of these nine parameters

Program Output Name	Parameter Description
TFF3	Conic time of free fall from present vehicle state to 300,000 feet above a spherical earth of radius 20,909,901 6 feet (sec) Note: For a detailed explanation of the equations used to compute TFF3, see Reference 6
HDOT	Altitude rate (ft/sec) $\dot{H}$ (HDOT) = $V_I * \sin \gamma_I$ V_I = inertial velocity magnitude, VV (ft/sec) γ_I = inertial flight-path angle, VTH (deg)

Program Output Name	Parameter Description
VEI3	Conic solution for entry inertial velocity at 300, 000 feet above a spherical earth with radius 20, 909, 901 6 feet (ft/sec) Note For a detailed explanation of the equations used to compute VEI3, see Reference 6
GEI3	Conic solution for entry inertial flight-path angle at 300, 000 feet above a spherical earth with radius 20, 909, 901 6 feet (deg) Note For a detailed explanation of the equations used to compute GEI3, see Reference 6
RAPO	Apogee radius measured from the center of the earth (ft)

Apogee radius (RAPO) $= \frac{(1 + e)}{\alpha}$

where e is the eccentricity of the orbit, and α is the reciprocal of the conic semimajor axis

$e = \sqrt{1.0 - \alpha * p}$

where

$p = \frac{1}{\mu} * (\vec{r} \times \vec{V}) \cdot (\vec{r} \times \vec{V})$ (semilatus rectum)

$\mu = 1\ 4076539E16\ ft^3/sec^2$

$\vec{r}$ is the position vector whose components are defined by XPP, YPP, and ZPP.

$\vec{V}$ is the velocity vector whose components are defined by DXPP, DYPP, and DZPP

RPER	Perigee radius measured from the center of the earth (ft)

Perigee radius (RPER) $= \frac{p}{1 + e}$

where p and e are defined above

CRNG	Circular range from $\vec{r}_B$ to the present position $\vec{r}$ (n mi)

Circular range (CRNG) $= R_{LP} * \cos^{-1} \frac{(\vec{r}_B \quad \vec{r})}{\left|\vec{r}_B\right| * \left|\vec{r}\right|}$

Program Output Name	Parameter Description
	R_{LP} (radius of launch pad) = 20, 909, 901. 6 ft
	$\vec{r}_B$ = position defined by first record in the present file unless the input NOEOF was set to 1 in the previous case which causes the value of $\vec{r}_B$ to be carried over from the previous case
WEDG	Wedge angle is the angle between the current orbital plane and the insertion orbital plane (deg)

$$\theta \text{ (wedge angle)} = \cos^{-1}\left[\frac{(\vec{r}_{siv} \times \vec{V}_{siv}) \cdot (\vec{r}_{ins} \times \vec{V}_{ins})}{|(\vec{r}_{siv} \times \vec{V}_{siv}| * |\vec{r}_{ins} \times \vec{V}_{ins})|}\right]$$

subscript siv = current vehicle state

subscript ins = insertion vehicle state

$\vec{r}_{siv}$ and $\vec{V}_{siv}$ are the vehicle state vectors as defined by the components in XPP, YPP, ZPP, DXPP, DYPP, and DZPP.

$\vec{r}_{ins}$ and $\vec{V}_{ins}$ are vehicle insertion state vectors input by the user as XINS, YINS, ZINS, DXINS, DYINS, and DZINS See Section 2 2 (Program Input Definition) for more details.

WTFL	Total fuel weight flow (all engines) (lb/sec)

Note: For the F tape format, this parameter is available from MSFC without internal calculation For the B7 tape format, the calculation is given below:

$$WTFL = \frac{\text{weight at previous point - present weight}}{\text{present time - time at previous point}}$$

Each group of data read from a record on the trajectory tape and the calculated parameters, if available, are output on a tape that is compatible with the TRWPLT program Also, if specified, an additional record is written at regular time intervals for plotting time ticks.

If the user desires punched cards, the program uses any selected parameters to output onto cards in any specified format When requested, the program outputs to the printer all parameters and their associated names along with any appropriate error messages In addition, the capability to generate tables utilizing user-specified output format is available

2.2 PROGRAM INPUT DEFINITION

The inputs to PNCH08 are an MSFC tape containing the trajectory data and punched cards containing instructions for the extraction of these data The format of the MSFC tape is discussed in Appendixes A and B of this report.

The punched card inputs are processed by the generalized input processor QQINPT which is discussed in Reference 2 The card format is free field with inputs in columns 1 - 72 The field restrictions and permissible data combinations which are imposed by QQINPT are listed below

a) The first card of every case must be a $RUN card

b) The last card of every data group is an END card, and the last card of every case must be a $ENDRUN card. If more input is needed after the $ENDRUN card (multiple cases), another $RUN card must be input before each additional group of input, and another $ENDRUN card must be input after each group of input

   1) $ENDRUN causes program reinitialization.

      - The MSFC input tape is rewound

      - All input variables values are returned to their preset values unless ICARRY has been set to 1

   2) END signifies the order of program execution

      - The groups of data separated by END cards are executed in sequential order.

      - All input variables values remain the same unless reinput

c) Each $RUN card must be followed by a processor card $DATA

d) An asterisk (*) terminates processing of a card This allows comments to be placed after an asterisk.

e) The dollar sign ($) must only appear as the first character on a card.

f) All input fields must be separated by a field delimiter The acceptable field delimiters are equal (=), comma (,), and left or right parenthesis ()

g) The three permissible types of input fields are symbols, numbers, and character strings

   1) Symbols consist of from one to six alphanumeric characters, the first character being alphabetic

   2) Numbers are either integer, octal, or floating.

      - Integer numbers have format $\pm n$ where n consists of 1 to 10 decimal digits (0 - 9).

      - Octal numbers have the format $\pm n$ where n consists of from 1 to 12 octal digits (0 - 7) If the number is preceded by a minus (-), it will be filled to 12 digits with trailing zeroes; otherwise, it will be filled to 12 digits with leading zeroes.

      - Floating numbers have four formats·

        $\pm n\ m$

        $\pm n.\ m \pm y$

        $\pm n\ \ m E \pm y$

        $\pm n\ \ m D \pm y$

        where n is an integer, m is a decimal fraction, and y is an integer exponent

   3) Character strings consist of characters set off by slashes (/). If a slash is desired within a string, it must be input as two slashes (//).

The specific inputs for PNCH08 are given in the following sections with a brief discussion for each input. Following the equal sign after the name of the variable is the type: I is integer, F is floating point, S is symbol, and // is character string.

2 2 1 General Inputs

Symbol	Preset Value	Definition
ADD(1) . . ADD(109) } = F	0 If it is desired to read a B7 or F tape, see Table 2-1 for the preset values	Value added to each variable before it is output
BIG(1) BIG(100) } = F	9 9E19 If it is desired to read a B7 or F tape, see Table 2-1 for the preset values.	Upper limits on extracted data If variable NAM(1) has a value greater than BIG(1) on tape, then this value is ignored and NAM(1) is not given a new value until the tape values are within the upper limit
FINAL = F	9. 9E19	When the record is read from IUNIT with this time (TS), the case is terminated
IBMTAP = I	0	Indicates how negative data are stored on IUNIT = 0, standard form (B7) = 1, complement form (F)
ICARRY = I	0	Flag to indicate whether program variables should be reset after the $ENDRUN card = 0, program variables assume the preset values = 1, all previous inputs are to remain
IDENT = //	Blank	Run identification (a maximum of 12 alphanumeric characters may be specified)
IFILE = I	1	File on IUNIT from which input data are to be extracted
INSREC = I	0	Specifies initial record to be considered as the launch site. This is used when the first records of an MSFC tape are in error
IOUNIT = I	8	Unit number of tape drive on which output plotting tape is to be written

Symbol	Preset Value	Definition
IUNIT = I	9	Unit number of tape drive on which input MSFC data tape is to be read
ISAVE = 0	0	Set equal to zero to indicate a new input tape is to be used for the current group of data
KKK = I	0	Flag specifying which output is desired = 0, printed output only = 1, plot tape and printed output = 2, plot tape, punched cards, and printed output = 3, punched cards and printed output = 4, IUNIT is a plot tape, output punched cards
N(1) . . N(100) } = I	0 If it is desired to read a B7 or F tape, see Table 2-1 for the preset values	Position or word number to be extracted from the records of IUNIT Value of N(1) will be output with NAM(1), N(2) with NAM(2), etc
NAM(1) . . NAM(109) } = S	Blank If it is desired to read a B7 or F tape, see Table 2-1 for the preset values	Symbolic names for output data. Output names for symbol records on the plot tape, printed with corresponding values on printed output and punched on cards with corresponding values, if desired
NOEOF = I	0	Flag indicating whether to put an end of file on the output plot tape or not = 0, write an end of file on the plot tape = 1, no end of file is to be written
NOPRNT = I	0	Flag indicating whether printed output is to be suppressed or not =-1, user-specified print output = 0, standard print output = 1, suppress standard print output

Symbol	Preset Value	Definition
SML(1) ... SML(100) = F	-9.9E19 If it is desired to read a B7 or F tape, see Table 2-1 for the preset values	Lower limits on extracted data, e.g., if variable NAM(1) from IUNIT has a value less than SML(1), then this value is ignored
START = F	0	The program begins processing data from IUNIT when time (TS) is equal or greater than this variable
TIMEB = F, F, .. F	0	Time to begin generating punched card output (maximum of 10 times may be specified)
TIMEI = F, F, F	0	Time intervals between output of punched cards (maximum of 10 intervals may be specified)
TIMEE = F, F, F	0	Time of final card punch (maximum of 10 times may be specified)
TIMTIC = F	60	Time increment for generating type 2 records on the output plot tape. Type 1 records are generated for each record read from IUNIT
TPTIM = I	2	Position of the time parameter (TS) in each record
TPTYPE = S	B7	Format of the MSFC tape for either B7 or F see Table 2-1
XML(1) ... XML(109) = F	1. If it is desired to read a B7 or F tape, see Table 2-1 for the preset values	Value that each variable is multiplied preceding output

2.2.2 Inputs for the Special Parameter Computations

Symbols	Preset Value	Definition
ICMPUT = I	1	Flag indicating whether the special parameter computation is to be performed = 0, do not perform the computations = 1, perform the computations

Symbol	Preset Value	Definition
RSUBLP = F	20909901.6	Radius of launch pad in feet
XINS YINS ZINS DXINS DYINS DZINS } = F	1 0	These six parameters are used in the computation of wedge angles and are the position and velocity components of the nominal insertion state vector in feet and feet per second They must be referenced to the coordinate system in Figure 2-2.

The following are parameters that are read from IUNIT and are used to calculate the special parameters If IUNIT is not a B7 or F format, the position of these variables in the records of IUNIT must be updated if the special parameter computation is desired

Symbol	Preset Value (B7)	Preset Value (F)	Definition
DXPP = I DYPP = I DZPP = I	137 138 139	122 123 124	Velocity components in the XPP system
LAMB = I	165	81	Longitude
PHI = I	164	83	Geodetic latitude
RRR = I	161	5	Radial distance of the c g from the center of the earth in the XPP system
TOTLWT = I	98	7	Total vehicle weight
VTH = I	157	85	Spaced-fixed path angle
VV = I	155	4	Magnitude of space-fixed velocity (XPP system)
XPP = I YPP = I ZPP = I	134 135 136	132 133 134	Position coordinates in the XPP system

If it is necessary to change the output units on any of the special parameters see Table 2-2

2 2 3 Inputs for User-Specified Format Tables

Symbol	Preset Value	Definition
LINES = I	40	Maximum number of lines per page
LSKIP = I	1	Number of lines to skip between last line of heading and first line of data
HED1L . . HED10L } = //	Blank	Left half of a line in the heading print The heading starts after the slash sign and includes the next 60 columns
HED1R HED10R } = //	Blank	Right half of a line in the heading print The heading for the right half starts after the slash sign and includes the next 60 columns By using both right- and left-heading variables, a table width of 120 columns may be obtained
ICOP = I, I, . I	0	Conversion option for each variable output = 1, time in seconds to hours, minutes, and seconds = 2, time in seconds to minutes and seconds = 3, degrees to degrees, minutes and seconds, hours to hours, minutes and seconds = 4, degrees to degrees and minutes
ITABLE = I, I, I	0	Array of numbers specifying desired variables to be output according to the corresponding TFORM variable, e.g., if NAM(1), NAM(2), and NAM(4) are wanted for table output according to TFORM, then ITABLE = 1, 2, 4 (maximum output of 20 variables)
TFORM = //	Blank	Format for each variable output The format starts after the slash and includes the next 120 columns The format statement may contain any format information acceptable to FORTRAN V The format statement must begin and end with parenthesis TFORM = /(1H, 1X, F7 2, F10 1)/

2 2.4 Inputs for User-Specified Format Punched Cards

If KKK is greater than 1, therefore, requesting punched output, and no values are given to IPNCH1 through IPNCH5, then the standard ARMP punched cards are output assuming variables are in order of B7 presettings.

Symbol	Preset Value	Definition
TITLCD = //	Blank	Title card (up to 60 alphanumeric characters may be output as the first of the group of punched cards)
FORM1 . . FORM5 } = //	Blank	Format for each variable output. The format starts after the slash and includes the next 72 columns The format statement may contain any format information acceptable to FORTRAN V. Each format must begin and end with a parenthesis. FORM1 = /(F7 2, 1X, . . F10 1)/. To delete a previous input FORM entry, input FORM1 = //
IPNCH1 . . . IPNCH5 } = I, I, . . I	0	Array of numbers specifying desired variables to be output according to the corresponding FORM variable; e g , if NAM(1), NAM(3), and NAM(5) are wanted for punched output or FORM1 format, IPNCH1 = 1, 3, 5 (maximum output for FORM1 format is 25 variables)
NPERC1 . NPERC5 } = I	1	Number of data values to be output per card for each FORM variable
NOSYM1 NOSYM5 } = I	0	Flag specifying whether symbolic names specified in NAM(1) through NAM(109) are desired to be output for the corresponding IPNCH variable There must be an A6 format specification in FORM variable to use this option properly. = 0, names will be output with values = 1, only values will be output

Table 2-1 Preset Array Values

Index	Quantity	NAM	N (B7)	N (F)	BIG (B7 or F)	SMALL (B7 or F)	XML (B7)	XML (F)	ADD (B7)	ADD (F)
1	Time (sec)	TS	2	2	3600	-360	1	1	0	0
2	Time (hr)	TH	2	2	1	-0 1	2777777E-3	2777777E-3	0	0
3	Pitch angle	PITCH	41	91	360	-360	1	1	90	-90
4	Yaw angle	YAW	42	92	360	-360	1	-1	0	0
5	Roll angle	ROLL	43	93	360	-360	1	0	180	0
6	Thrust	THST	97	8	1 E8	-10	FNTTLB	FKGTLB	0	0
7	Longitude	LONG	165	81	360	-360	1	-1	0	0
8	Declination	DEC	164	83	360	-360	1	1	0	0
9	Inertial azimuth	AZ	153	88	360	-360	1	1	0	0
10	Vehicle weight	WGHT	98	7	1 E8	100	FKGTLB	FKGTLB	0	0
11	Inertial flight-path angle	GAMA	157	85	90	-360	-1	1.	0	0
12	Radius vector magnitude	RADI	161	5	25 E6	20908000	FMTTFT	FMTTFT	0	0
13	Inertial velocity	VELO	155	4	3 E4	0 0	FMTTFT	FMTTFT	0	0
14	Geodetic latitude	LATD	86	110	360	-360	1	1	0	0
15	Geodetic altitude	ALT	162	3	1000	0 0	5399568E-3	5399568E-3	0	0
16	X, Y, and Z components	X	134	132	25 E6	-22 E6	FMTTFT	FMTTFT	0	0
17	of vehicle position	Y	135	133	25 E6	-22 E6	FMTTFT	FMTTFT	0	0
18	vectors	Z	136	134	25 E6	-22 E6	FMTTFT	FMTTFT	0	0
19	X, Y, and Z components	DX	137	122	3 E4	-26000	FMTTFT	FMTTFT	0	0
20	of vehicle velocity	DY	138	123	3 E4	-26000	FMTTFT	FMTTFT	0	0
21	vectors	DZ	139	124	3 E4	-26000	FMTTFT	FMTTFT	0	0
22		Blank	0	0	9 9E19	-9 9E19	1	1	0	0
100		Blank	0	0	9 9E19	-9 9E19	1	1	0	0

Table 2-2. Computed Parameters Array Locations

Index	Quantity	Units	NAM	XML	ADD
101	Weight flow	lb/sec	WTFL	1	0
102	Time of free fall to 300, 000 feet	sec	TFF3	1.	0.
103	Altitude rate	ft/sec	HDOT	1	0.
104	Predicted velocity at 300, 000 feet	ft/sec	VEI3	1	0
105	Predicted flight-path angle at 300, 000 feet	deg	GEI3	1	0.
106	Circular range from the launch pad	n mi	CRNG	1.	0.
107	Radius of apogee	ft	RAPO	1	0.
108	Radius of perigee	ft	RPER	1	0.
109	Wedge angle	deg	WEDG	1	0.

2.3 COORDINATE SYSTEMS

Figures 2-1 and 2-2 define the coordinate systems used by the Euler angle calculations and the position and velocity vector components. The X_{PP}, Y_{PP}, Z_{PP} inertial coordinate system defined in Figure 2-2 is used as the base for the three ordered rotations shown in Figure 2-1.

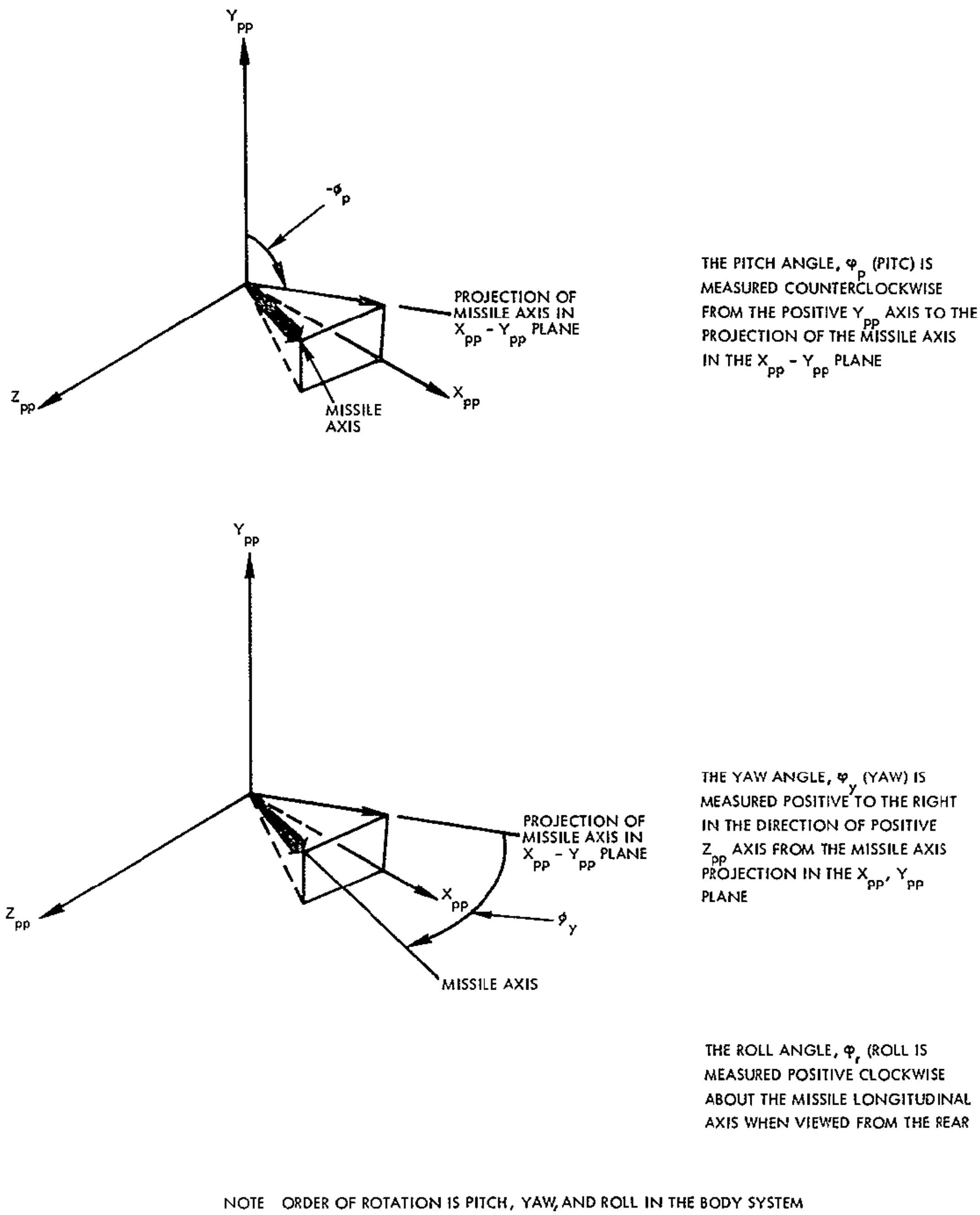
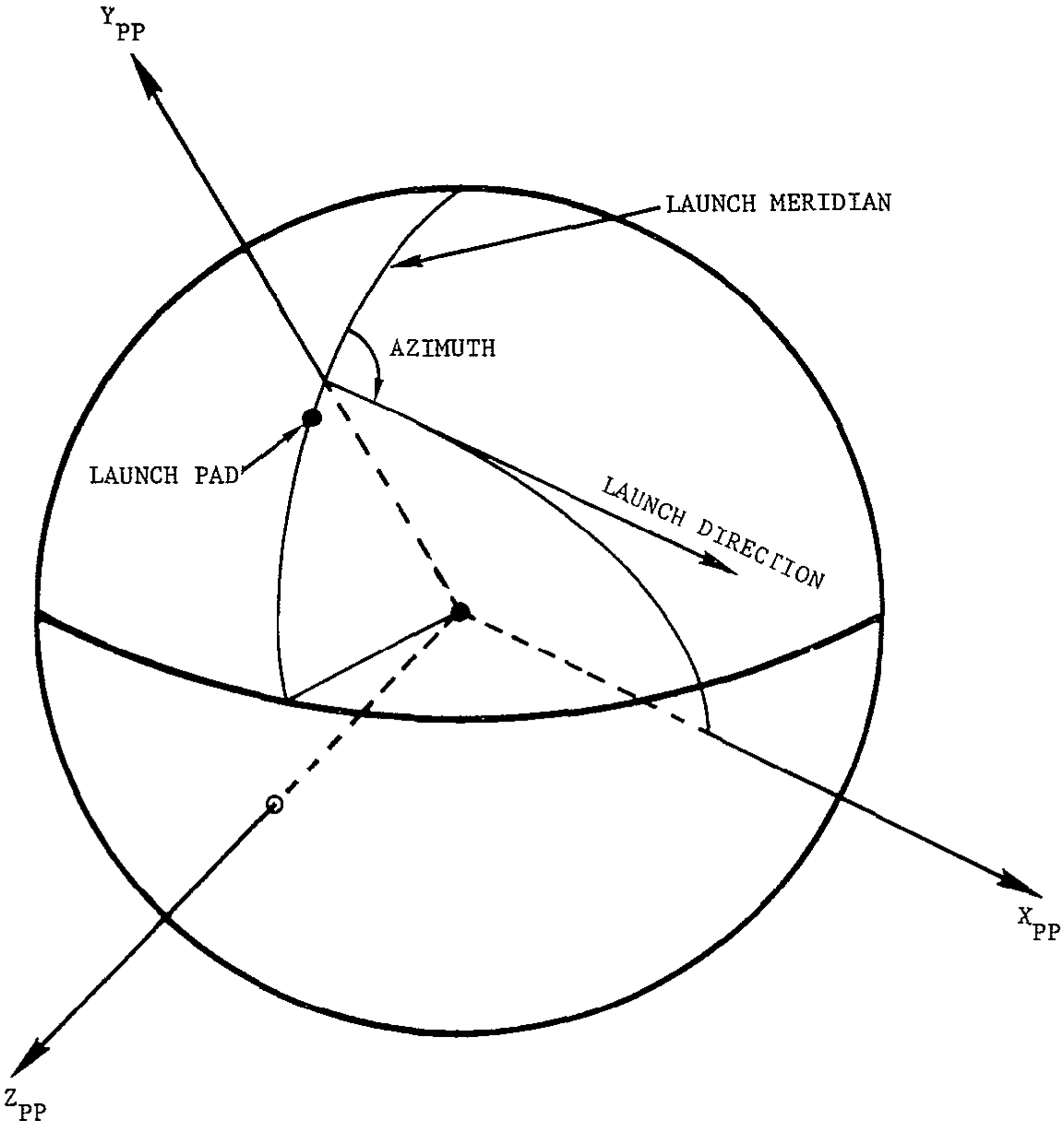


Figure 2-1 Definition of Euler Angles



DEFINITION: THE Y_{PP} AXIS GOES THROUGH THE LAUNCH MERIDIAN AND IS PARALLEL TO THE GRAVITY GRADIENT AT THE LAUNCH PAD. THE X_{PP} AXIS IS PARALLEL TO THE EARTH-FIXED FLIGHT AZIMUTH. THE Z_{PP} AXIS IS PERPENDICULAR TO THE PLANE FORMED BY THE X_{PP} - Y_{PP} PLANE AND COMPLETES RIGHT-HANDED COORDINATE SYSTEM. THIS COORDINATE SYSTEM IS DEFINED AT GUIDANCE REFERENCE RELEASE.

Figure 2-2. Earth-Centered Inertial Plumbline Coordinate System

2 4 THE MERGE PROCESSOR

The PNCH08 MERGE processor is used to combine any previously generated plot tapes The processor assigns specified record types to each unique data type so that the TRWPLT program can plot multiple trace graphs. The TRWPLT tape format is shown in Appendix C, and additional information may be found in Reference 5. MERGE employs the same input processor as presented in Section 2.2 except $MERGE is input in place of $DATA.

Symbol	Preset Value	Definition
IUNIT = I	0	Unit number of tape drive on which input data are to be read
IOUNIT = I	0	Unit number of tape drive on which output data are to be written
IFILE = I	0	File on IUNIT from which input data are to be extracted
GETREC = I	0	Data record type to be extracted from IUNIT
PUTREC = I	0	New data record type number that replaces the corresponding value of the extracted record type to be written on IOUNIT

2 5 SAMPLE CASES

The sample cases that follow illustrate the various inputs and capabilities of the PNCH08 program.

Figure 2-3 illustrates the inputs for the first example. The example is divided into three test cases as indicated by the IDENT variable File 1 of an MSFC B7 trajectory tape mounted on unit 9 serves as the input data tape. In test case 1, one file of plot data is generated with the preset 30 parameters, including the special parameters, on unit 8 The plot tape consists of record type 1 data for every time point and record type 2 data for every 60 seconds. Additionally, the normal print and fixed format punched cards are output as shown in Figure 2-4. Test case 2 illustrates a stacked run. The program is reinitialized to the preset values on

encountering the $ENDRUN card. The specified variables and names are printed and punched on cards. Test case 3 is the same as test case 2 except that the variable names are not output, but the data are named by using hollerith field. The output for test cases 2 and 3 is shown in Figure 2-5.

The inputs for example 2 are shown in Figure 2-6. Example 2 consists of test cases 4 and 5 which read the MSFC trajectory tape on unit 9 Test case 4 illustrates the user specified table format, and the output table is shown in Figure 2-7. Test case 5 merges the plot tape generated by test case 4 and a previously generated plot tape on unit 10.

```
  ASG G=XXXXX                          MSFC LAUNCH TRAJECTORY TAPE
  ASG X=XXXXX                          PNCH08 PCF TAPE
  ASG F=SCRATCH OR                     OUTPUT UNIT FOR TRWPLT
        SAVE                           FORMATTED TAPE
  XQT CUR                              EXECUTE THE FOLLWING INSTRUCTIONS
      TRW X,G,H                        REWIND UNIT X,G AND H
      IN X                             INPUT THE ENTIRE PCF FROM UNIT X
      TRI X                            REWIND AND INTERLOCK UNIT X
  XQT PNCH08                           EXECUTE THE PNCH08 PROGRAM
*********************************************************************************
$RUN                                  *INITIALIZE PROGRAM
$DATA                                 *DATA CARD INPUT IS TO FOLLOW
 IDENT= /TEST CASE 1/                 *RUN IDENTIFICATION
 IUNIT=9                              *MSFC TRAJECTORY IS ON UNIT 9(G)
 IFILE=1                              *PROCESS FIRST FILE
 KKK=2                                *PRODUCE PLOT TAPE AND PUNCHED CARDS
 IOUNIT=8                             *PLOT TAPE UNIT
 XINS=9763834.1                       *X,Y AND Z POSITION COMPONENTS
 YINS=19190164.0                      *OF VEHICLE INSERTION VECTOR
 ZINS=304548.49                       *FOR WEDGE ANGLE COMPUTATIONS
 DXINS=22784.927                      *X,Y, AND Z VELOCITY COMPONENS
 DYINS=-11596.764                     *OF VEHICLE INSERTION VECTOR
 DZINS=248.14083                      *FOR WEDGE ANGLE COMPUTATIONS
 FINAL=800.                           *TERMINATE AT 800 SECONDS AFTER L/O
 TIMEB=760.                           *BEGIN PUNCHING CARDS AT 760 SECONDS
 TIMEI=10.                            *PUNCH CARDS EVERY 10 SECONDS
 TIMEE=790.                           *END PUNCHING CARDS AT 790 SECONDS
 END                                  *END OF THIS DATA GROUP
$ENDRUN                               *END OF CASE
*********************************************************************************
$RUN                                  *INITIALIZE PROGRAM
$DATA                                 *DATA CARD INPUT IS TO FOLLOW
 IDENT=/ TEST CASE 2/                 *RUN IDENTIFICATION
 TPTYPE=X                             *NOT A B7 OR F FORMAT MSFC TAPE
 IUNIT=9                              *INPUT UNIT FOR TRAJECTORY TAPE
 KKK=3                                *GENERATE PUNCHED CARDS AND PRINT
```

Figure 2-3 Example 1 PNCH08 Input

```
 START=10.                                   *START PROCESSING THE DATA AT 10 SECONDS
 FINAL=100.                                  *STOP PROCESSING AT 100 SECONDS
 NAM=TS,X,Y,Z,DX,DY,DZ,MASS                  *OUTPUT VARIABLE NAMES CORRESPONDING
                                             * TO N(1) THRU N(8) FROM THE DATA TAPE
 N=2,134,135,136,137,138,139,98              *WORD LOCATION ON THE MSFC TAPE RECORDS
                                             * TO OBTAIN DESIRED DATA
 BIG=3600.,25.E6,25.E6,25.E6                 *UPPER LIMITS ON
 BIG(5)=3.E4,3.E4,3.E4,1.E8                  * EXTRACTED DATA
 SML=-360.,-22.E6,-22.E6,-22.E6              *LOWER LIMITS ON
 SML(5)=-26.E3,-26.E3,-26.E3,100.            * EXTRACTED DATA
 XML(2)=3.2808399,3.2808399,3.2808399        *CONVERSION FACTOR MULTIPLIERS
 XML(5)=3.2808399,3.2808399,3.2808399        *CONVERSION FACTOR MULTIPLIERS
 XML(8)=2.20462262                           *CONVERSION FACTOR MULTIPLIERS
 TPTIM=2                                     *POSITION OF THE TIME PARAMETER
 ICMPUT=0                                    *DO NOT PERFORM SPECIAL COMPUTATION
 TITLCD=/FREE FIELD PUNCH WITH SYMBOLIC NAMES OUTPUT/
 IPNCH1=1,8                                  *PUNCH TS AND MASS ACCORDING TO
 FORM1=/(1X,A6,1H=,F10.2,1H,,A6,1H=,F10.2)/  *FORMAT 1(FORM1)
 NPERC1=2                                    *OUTPUT TWO DATA VALUES PER CARD
 IPNCH2=2,3,4,5,6,7                          *PUNCH THE INDICATED VARIABLES
 FORM2=/(1X,A6,1H=,F14.5)/                   *ACCORDING TO FORMAT 2(FORM2)
 NPERC2=1                                    *OUTPUT ONE DATA VALUE PER CARD
 TIMEB=10.,90.                               *BEGIN PUNCHING CARDS AT 10 AND 90 SEC
 TIMEI=1.,1.                                 *PUNCH EVERY SECOND
 TIMEE=12.,92.                               *STOP PUNCHING CARDS AT 12 AND 92 SEC
END                                          *END OF THIS DATA GROUP
*****************************************************************************************
 IDENT=/ TEST CASE 3/
 START=101.                                  *START PROCESSING THE DATA AT 101 SECOND
 FINAL=110.                                  *STOP PROCESSING THE DATA AT 110 SECONDS
 TIMEB(3)=101.                               *PUNCH CARDS AT
 TIMEE(3)=101.                               * 101 SECONDS
 TITLCD=/FREE FIELD PUNCH WITHOUT SYMBOLIC NAMES/
 NOSYM1=1,NOSYM2=1,NOSYM3=1                  *DO NOT OUTPUT DATA-WORD SYMBOLS
 IPNCH2(4)=0,0,0                             *CLEAR IPNCH4,IPNCH5 AND IPNCH6
 NPERC2=3                                    *OUTPUT THREE DATA VALUES PER CARD
```

Figure 2-3. Example 1 PNCH08 Input (Continued)

```
 IPNCH3=5,6,7                                      *PUNCH THE INDICATED VARIABLES
 NPERC3=3                                          *OUTPUT THREE DATA VALUES PER CARD
 FORM1=/(1X,3HTS=,F10.5,6H,MASS=,F10.2)/
 FORM2=/(1X,2HX=,F14.5,3H,Y=,F14.5,3H,Z=,F14.5)/
 FORM3=/(1X,3HDX=,F14.5,4H,DY=,F14.5,4H,DZ=,F14.5)/
END                                                *END OF THIS DATA GROUP
$ENDRUN                                            *END OF CASE
```

Figure 2-3. Example 1 PNCH08 Input (Continued)

```
************************************************
 ** PUNCHED CARD OUTPUT **

PHASE(20,1) = ABORT TIME    .77000000+03 SEC. FROM LAUNCH
PHASE(20,0,3) = ABORT TIME    .77000000+03 SEC. FROM LAUNCH
 RA =  -48.38384485, DEC =   32.53597498, AZ =    91.25259876*
 PTH =     -.00056458*
 R =  21533399.500000*
 V =   25568.45923*
 TSTART =     .213888887*    .77000000+03 SEC. FROM LAUNCH
 DTLAND =     .213888887*    .77000000+03 SEC. FROM LAUNCH
 TMAX   =     .213888887*    .77000000+03 SEC. FROM LAUNCH
 IMASS =   299770.7148437*INITIAL WEIGHT
 ROLL(1) =  -30.62297058,     .51063947, 180.00000000*EULER ANGLES
 WRTABL, FMLT =       1.580129*WEIGHT FLOW
 TTABLE, FMLT =       186.7999821*THRUST
************************************************
TS     =  .53400000+03 TH    =  .14833333+00 PITC  = -.46643448+01 YAW   =  .28609459+00 ROLL  =  .17999887+03
THST   =  .69094835+06 LONG  = -.65403042+02 DEC   =  .31581389+02 AZ    =  .81688459+02 WGHT  =  .50588277+06
GAMA   =  .70134830+00 RADI  =  .21515287+08 VELO  =  .21765057+05 LATD  =  .31748458+02 ALT   =  .10020479+03
X      =  .57134662+07 Y     =  .20741226+08 Z     =  .25580638+06 DX    =  .21049883+05 DY    = -.55257532+04
DZ     =  .29362739+03
WTFL   =  .16052578+04 TFF3  =  .30352813+03 HDOT  =  .26641586+03 VEI3  =  .22193649+05 GEI3  = -.58824744+01
CRNG   =  .81192826+03 RAPO  =  .21519515+08 RPER  =  .12204930+08 WEDG  =  .56388349-01

 RECORD  557 TICS =   8

************************************************
TS     =  .53500000+03 TH    =  .14861111+00 PITC  = -.48128557+01 YAW   =  .29012099+00 ROLL  =  .17999888+03
THST   =  .69074996+06 LONG  = -.65339829+02 DEC   =  .31589759+02 AZ    =  .81722430+02 WGHT  =  .50427787+06
GAMA   =  .69949150+00 RADI  =  .21515554+08 VELO  =  .21808061+05 LATD  =  .31756850+02 ALT   =  .10025014+03
X      =  .57345342+07 Y     =  .20735684+08 Z     =  .25609991+06 DX    =  .21085687+05 DY    = -.55587046+04
DZ     =  .29343527+03
WTFL   =  .16049023+04 TFF3  =  .30541566+03 HDOT  =  .26623555+03 VEI3  =  .22236188+05 GEI3  = -.58424358+01
CRNG   =  .81520113+03 RAPO  =  .21519820+08 RPER  =  .12281151+08 WEDG  =  .54625776-01

 RECORD  558 TICS =   8
```

Figure 2-4   Printed and Punched Output Generated by Example 1 Test Case 1

```
**************************************************
TS     =  .52000000+02 X      =  .72349605+05 Y      =  .20922704+08 Z      =  .84831241+05 DX     =  .14848368+04
DY     =  .60527240+03 DZ     =  .41318198+03 MASS   =  .49291089+07

 RECORD   44 TICS =    0

**************************************************
TS     =  .53000000+02 X      =  .73841729+05 Y      =  .20923318+08 Z      =  .85244343+05 DX     =  .14994618+04
DY     =  .62346376+03 DZ     =  .41302109+03 MASS   =  .49002264+07

 RECORD   45 TICS =    0

**************************************************
TS     =  .54000000+02 X      =  .75348781+05 Y      =  .20923951+08 Z      =  .85657285+05 DX     =  .15146960+04
DY     =  .64188408+03 DZ     =  .41286268+03 MASS   =  .48713439+07

 RECORD   46 TICS =    0

**************************************************
 ** PUNCHED CARD OUTPUT **

FREE FIELD PUNCH WITH SYMBOLIC NAMES OUTPUT
TS     =      92.00,MASS  =3770139.94
X      =  150433.07031
Y      =20963330.00000
Z      =  101243.74512
DX     =    2633.57962
DY     =    1464.63228
DZ     =     407.67965
**************************************************
 ** PUNCHED CARD OUTPUT **

FREE FIELD PUNCH WITHOUT SYMBOLIC NAMES
TS= 101.00000,MASS=3508077.94
X=  176302.79297,Y=20977434.75000,Z=  104808.12793
DX=    3114.64246,DY=    1667.26080,DZ=      405.46081
**************************************************
```

Figure 2-5. Printed and Punched Output Generated by Example 1 Test Cases 2 and 3

```
  ASG G=XXXXX                                  MSFC LAUNCH TRAJECTORY TAPE
  ASG H=XXXXX                                  PREVIOUSLY GENERATED PLOT TAPE
  ASG X=XXXXX                                  PNCH08 PCF TAPE
  ASG F=SCRATCH OR                             OUTPUT UNIT FOR TRWPLT
        SAVE                                   FORMATTED TAPE
  XQT CUR                                      EXECUTE THE FOLLWING INSTRUCTIONS
      TRW X,G                                  REWIND UNIT X AND G
      IN X                                     INPUT THE ENTIRE PCF FROM UNIT X
      TRI X                                    REWIND AND INTERLOCK UNIT X
  XQT PNCHC8                                   EXECUTE THE PNCH08 PROGRAM
***************************************************************************
$RUN                                          *INITIALIZE PROGRAM
$DATA                                         *DATA CARD INPUT TO FOLLOW
 IDENT= /TEST CASE 4/                         *RUN IDENTIFICATION
 IUNIT=9                                      *MSFC TRAJECTORY TAPE IS ON UNIT 9(G)
 IFILE=1                                      *PROCESS FIRST FILE OF THE MSFC TAPE
 IOUNIT=8                                     *OUTPUT PLOT TAPE GENERATED ON UNIT 8(F)
 NOPRNT=-1                                    *PRINT TABLES ONLY
 LINES=40                                     *TOTAL LINES PER PAGE
 LSKIP=1                                      *LINES TO SKIP AFTER HEADING
 HED1L = /               TABLE III.  TYPICAL DSKY PARAMETRS DURING THE /
 HED2L = /                           THE APOLLO 13 (MISSION H-2)       /
 HED3L = //
 HED4L = /-------------------------------------------------------------/
 HED5L = //
 HED6L = /  GROUND                                                     /
 HED7L = / ELAPSED      INERTIAL                ALTITUDE  PREDICTED  PRED/
 HED8L = /   TIME       VELOCITY   ALTITUDE       RATE     PERIGEE    APO/
 HED9L = /(MIN SEC)    (FT//SEC)    (N MI)     (FT//SEC)    (N MI)    (N/
 HED9L(10) = /   (N /
 HED1R = /LAUNCH FOR/
 HED2R = //
 HED3R = //
 HED4R = /-------------------------/
 HED5R = /        PREDICTED/
 HED6R = /         TFF TO     PITCH/
```

Figure 2-6. Example 2 PNCH08 Input

```
 HED7R = /ICTED   300,000    GIMBAL/
 HED8R = /GEE       FEET     ANGLE /
 HED9R = /MI)    (MIN SEC)   (DEG) /

 NAM(22)=ALT,N(22)=161                       *ALTITUDE ABOVE A SPHERICAL
 XML(22)=.5399568E-03,ADD(22)=-3441.3433 *EARTH
 XML(107)=.16457883E-03,ADD(107)=-3441.3433 *CONVERT RADIUS OF APOGEE
 XML(108)=.16457883E-03,ADD(108)=-3441.3433 *PERIGEE TO ALTIUDE IN N MI
 ITABLE=1,13,15,103,108,107,102,3         *VARIABLES TO BE OUTPUT ON THE TABLE
 ICOP(1)=2,ICOP(7)=2                      *CONVERT 2ND + 7TH VARIABLES TO MIN SEC
                  *THE FORMAT VARIABLE(TFORM) SPECIFIES THE FORMAT THE
                  * VARIABLE WILL BE OUTPUT ON TABLE
 TFORM = /(1H ,I4,F6.2,F10.0,F11.1,F11.0,F11.1,F9.1,6X,I3,F6.2,F7.1)/
 END                                      *END OF THIS DATA GROUP
$ENDRUN                                   *END OF CASE
******************************************************************************
$RUN                                      *INITIALIZE PROGRAM
$MERGE                                    *INPUT DATA FOR MERGE IS TO FOLLOW
 IDENT=/ TEST CASE 5/
 IUNIT=10                                 *PLOT TAPE TO COPY FROM (INPUT)
 IOUNIT= 8                                *PLOT TAPE TO ADD TO (OUTPUT)
 IFILE=1                                  *FILE TO EXTRACT INPUT DATA
 GETREC=1,2                               *RECORD TYPES TO READ FROM IUNIT
 PUTREC=3,4                               *RECORD TYPES TO BE OUTPUT TO IOUNIT
 END                                      *END OF THIS DATA GROUP
$ENDRUN                                   *END OF CASE
```

Figure 2-6. Example 2 PNCH08 Input (Continued)

TABLE III. TYPICAL DSKY PARAMETRS DURING THE LAUNCH FOR THE APOLLO 13 (MISSION H-2)

GROUND ELAPSED TIME (MIN SEC)	INERTIAL VELOCITY (FT/SEC)	ALTITUDE (N MI)	ALTITUDE RATE (FT/SEC)	PREDICTED PERIGEE (N MI)	PREDICTED APOGEE (N MI)	PREDICTED TFF TO 300,000 FEET (MIN SEC)	PITCH GIMBAL ANGLE (DEG)
1 56.00	4598.	15.9	2038.	-3397.0	26.9	0 .00	34.9
1 58.00	4755.	16.6	2084.	-3393.6	28.1	0 .00	34.2
2 .00	4916.	17.3	2131.	-3389.9	29.4	0 .00	33.5
2 2.00	5082.	18.0	2179.	-3386.0	30.7	0 .00	32.8
2 4.00	5253.	18.7	2226.	-3381.9	32.0	0 .00	32.1
2 6.00	5428.	19.5	2275.	-3377.4	33.4	0 .00	31.3
2 8.00	5609.	20.2	2324.	-3372.6	34.8	0 .00	30.7
2 10.00	5795.	21.0	2373.	-3367.5	36.2	0 .00	30.0
2 12.00	5987.	21.8	2424.	-3362.0	37.7	0 .00	29.3
2 14.00	6184.	22.6	2475.	-3356.1	39.3	0 .00	28.6
2 16.00	6371.	23.4	2518.	-3350.3	40.8	0 .00	27.9
2 18.00	6529.	24.3	2546.	-3345.0	42.1	0 .00	27.3
2 20.00	6692.	25.1	2574.	-3339.5	43.4	0 .00	26.8
2 22.00	6858.	26.0	2603.	-3333.7	44.7	0 .00	26.3
2 24.00	7029.	26.8	2633.	-3327.5	46.1	0 .00	25.8
2 26.00	7205.	27.7	2663.	-3320.9	47.5	0 .00	25.2
2 28.00	7385.	28.6	2694.	-3314.0	48.9	0 .00	24.7
2 30.00	7570.	29.5	2725.	-3306.7	50.4	1 54.66	24.2
2 32.00	7760.	30.4	2758.	-3298.9	51.9	2 8.18	23.7
2 34.00	7955.	31.3	2790.	-3290.7	53.5	2 18.77	23.2
2 36.00	8156.	32.2	2824.	-3282.0	55.1	2 28.11	22.7
2 38.00	8362.	33.2	2859.	-3272.7	56.7	2 36.76	22.2
2 40.00	8575.	34.1	2895.	-3262.9	58.4	2 45.01	21.7
2 42.00	8794.	35.1	2931.	-3252.4	60.1	2 53.02	21.2
2 44.00	9012.	36.0	2966.	-3241.6	61.9	3 .63	20.9
2 46.00	9007.	37.0	2916.	-3240.8	62.0	2 59.28	20.7
2 48.00	9001.	38.0	2865.	-3240.2	62.1	2 57.79	20.6
2 50.00	9019.	38.9	2823.	-3238.5	62.4	2 57.24	20.8
2 52.00	9046.	39.8	2785.	-3236.3	62.7	2 57.01	21.0

Figure 2-7 Output from Example 2 Test Case 4

3. REPORT GENERATOR PROGRAM

The Report Generator Program allows the user to construct tables in any desired format and to generate input tapes for the TRWPLT program from precomputed data stored on the variable format tape by the Apollo Reference Mission Program (ARMP). Although the report generator was developed and documented under another task (Reference 4), significant modifications were made that necessitated republishing the user's manual

3 1 PROGRAM DESCRIPTION

The Report Generator is written in FORTRAN V and was developed to be run on the UNIVAC 1108 computer It expects variable format data from ARMP (Reference 7) to be taken from logical unit F (physical unit 8) and the input program data to be input from the card reader (physical unit 5), logical unit U (physical unit 24), or both The table output can appear as punched cards, printer output, or microfilm depending upon the user selected output device. The TRWPLT input tape is always written on logical unit G (physical unit 9).

The program uses the ARMP input routine with data stored and executed in phases. The phases consist of the inputs that appear prior to an ENDTAB input, and all input data carry over from one phase to another. The phase inputs can be divided into three types those controlling the input of data from the variable format tape, those controlling the internal manipulation of the input data, and those specifying the output quantities and formats

3 1 1 Data Input

After initialization, the program data are read from the card reader (physical unit 5) until it encounters an ENDTAB input that signals the end of the input data for a phase. The phase is then executed according to the options specified in the phase, and upon completion, the program returns to the card reader for input data for the next phase. This procedure is followed until the completion of the report is specified by a ∇ EOF input.

If a data tape is to be used with the report generator program, the program will read data from the data tape when the value of IFILE becomes different from its preset value of 0. If IFILE appears as a positive integer in the card input, the program will stop reading data from the card reader and begin reading data from the file on logical tape unit U (physical unit 24) which is equal to the value of IFILE. The data are read from the data tape until the value of IFILE is again set equal to 0 by the data tape input. A value of 0 causes the program to return to the card reader for additional input, and the card reader remains the input source until the value of IFILE becomes equal to -1 from card input. When IFILE = -1, the program returns to the data tape for input until IFILE is again set equal to 0. This process is illustrated by the following example:

Card Input		Data Tape Input
IFILE = 10 →	Go to file 10 on unit U →	III = 0 IVEH = 1
		.
		.
TOTPHA = 1 ←	Go to card reader for additional input ←	IFILE = 0
PHASE = 1		
IFILE = -1 →	Return to file 10 on unit U →	ENDTAB
		.
TOTPHA = 2 ←	Return to card reader for additional input ←	IFILE = 0
PHASE = 1, 2		
ENDTAB		
∇ EOF →	End execution	

Phases that require input from the variable format tape must have the following quantities specified in the report generator input.

a) IVEH specifies the vehicle for which data are to be input.

b) NVAR specifies the number of variables to be read from each record of every phase on the variable format tape specified by PHASE.

c) PHASE specifies the phase or phases on the variable format tape to be processed.

d) REC$ specifies the record or records to be processed in the phases on the variable format tape given by the variable PHASE.

e) SYMB specifies the symbol names to be read from the phases on the variable format tape given by the variable PHASE.

f) TOTPHA specifies the total number of phases to be processed on the variable format tape.

When the report generator is used, as shown in Figures 3-1 through 3-4, to generate tabular reports (ISTOR = 0), the variable format data are input to the program and output in report form in the same phase. One record at a time is read, processed, and output. The variables listed above are, therefore, all that are required to specify the input and output processing.

If the report generator is used, as illustrated in Figures 3-5 through 3-8, to generate a summary sheet or to generate a table of data from different records (ISTOR = 2), then the variable format data may be read and stored in an internal array and processed and output in succeeding phases. The array is one dimensional and contains 500 elements. Variable format data may be stored in the array by employing the option "ISTOR = 1" during a data input phase. The program stores the data in consecutive locations beginning with the location specified in NDATA Therefore, the variables ISTOR and NDATA must be input in addition to the variables listed above for input phases in which data are internally stored.

If the variable format tape contains data from more than one trajectory and it is necessary to use the ISTOR = 2, ISTOR = 1 combination, then two sequential report generator phases are repeated the number of times specified by TOTCAS. It is also necessary to put REPEAT after the second ENDTAB to signal the end of the loop that was initiated by the TOTCAS card.

3 1 2 Processing of Data

The data from the variable format tape can be converted to different units before they are output, or the four arithmetic operations of addition (ADD), subtraction (SUB), multiplication (MUL), and division (DIV) can be performed on any variable prior to its being output The report generator variable "ICOP" controls the conversions and allows the arithmetic operations to performed. Sixteen possible options exist for ICOP (Section 3. 1. 3). Seven options are conversions that change a variable from one unit of measure to another. Four options allow a single time input to be expressed in hours, minutes, and seconds or minutes and seconds. Five options convert angular measure in degrees or radians to either degrees, minutes, and seconds, degrees and minutes, or hours, minutes, and seconds. The remaining two options are related to the capability to perform arithmetic operations One of the remaining two options (ICOP = 1) signals the program that arithmetic operations are to be performed The other option (ICOP = 2) allows the value that results from an arithmetic operation to be converted to other units by any of the other ICOP options

Each variable to be converted must have an associated value of ICOP to specify the conversion Variables upon which arithmetic operations are to be performed must have either one or three values of ICOP One value (ICOP = 1) signifies that arithmetic operations are to be performed and the resultant value output. Three values (ICOP = 1, 2, and N) signify that arithmetic operations are to be performed and the result is to be converted to the units specified by option N.

ICOP must be input in conjunction with the variable "SYMB" which specifies the variables that are to be converted, the arithmetic operations to be performed, and the variables to be operated on. The arithmetic operators are specified by the symbols ADD, SUB, MUL, and DIV and are

performed from left to right as specified by the SYMB input. The variables specified by SYMB can be operated on by other variables or by constants. The operators are separated from the operands by commas, and a series of operations is terminated by the word ENDOP. The use of ICOP and SYMB in ISTOR = 0 phases can be illustrated by the following example:

SYMB = LON, R, RAN, TA, DIV, 3.1415, ENDOP

SYMB = X, MUL, 2 , ADD, R, ENDOP

ICOP = 0, 11, 6, 1, 1, 2, 12

The values of ICOP have the following meaning:

a) The first variable (LON) is not to be converted to any other units, and no arithmetic operations are performed.

b) The second variable (R) is to be converted from feet to nautical miles.

c) The third variable (RAN) is to be converted from degrees to degrees, minutes, and seconds.

d) The fourth variable (TA) is to be divided by the value 3.1415.

e) The fifth variable (X) is to be multiplied by 2.0 and added to the variable R. The result is to be converted from feet to meters.

For phases in which ISTOR = 2 the use of SYMB and ICOP are illustrated as follows:

SYMB = 1, 1, ADD, 2, ENDOP

ICOP = 0, 1, 2, 12

The values of ICOP have the following meaning:

a) The variable stored in location 1 of the internal array is output without either conversions or arithmetic operations performed.

b) The variable stored in location 1 of the internal array is added to the variable stored in location 2 and the result converted from feet to nautical miles.

The report generator also contains the capability to process data by sampling each data record to determine if one of the variables in the record is equal to a value or is in a range of values specified by the user. This variable is termed the critical variable. If the critical variable is not equal to a specified value, or is in a specified range of values, the output of that record will be suppressed. These options are available with the critical variable option (critical variable equal to specified value) and the block record skip option (critical variable within a specified range of values).

The critical variable option allows the user to specify the output of only those records in which a specified variable within the data record is equal to the corresponding value of the symbol CRITV. The critical variable must be one of the variables specified by SYMB, and its index within SYMB is specified by the variable "INCV." Critical variable values (CTRIV) must be input for each record for which the critical variable will be tested. The number of critical variable values input is specified by NCV with a maximum allowable input of 99 values.

The critical variable option can be expanded to allow records to be output when the critical variable falls within a range of values. This can be done by specifying a positive or negative tolerance on the values of CRITV with the symbols TOLP or TOLN, respectively. The acceptable critical values then become those lying between CRITV + TOLP and CRITV - TOLN. An example of the use of the critical value option is given in Figure 3-1

The block record skip option is different than the critical value option in that the output of data from certain records is suppressed if the critical value assumes a value which falls within an interval specified in the variable "BRS." Each pair of values in BRS defines the interval with the first value becoming the lower bound and the second value becoming the upper bound. When the critical value becomes larger than the upper bound of an interval, the next interval (with its lower and upper bounds) is used for testing the critical variable value. The number of intervals input in

BRS is specified by the variable "NBRS." The maximum number of intervals is 40. An example of the block record skip option is given in Section 3.2 under the definition of BRS

3 1.3 Data Output

If the report generator is used to generate a tabular report (no data stored in the internal array), the data are input and output in the same phase. The additional quantities that must be specified for output processing are NTAPE and FMT$. NTAPE specifies whether the data are to be output on punched cards, on the printer (physical unit 6), or on microfilm (physical unit 17). FMT$(IA) specifies the format for each variable output with IA defining the order of the format blocks input if the format statement occupies more than 60 columns The format statement may contain any format information acceptable to FORTRAN V Each format statement must begin and end with a left- and right-hand parenthesis, respectively, and will carry over from one phase to another. A good example of the use of the format statement is illustrated in Figure 3-5.

If the report generator is used to generate a summary sheet using the internal storage array, the output of data must take place in an output phase (ISTOR = 2). In addition to NTAPE and FMT$, the variables NVAR, SYMB, and ICOP must be input. NVAR contains the number of variables to be output, SYMB gives the location in the internal storage array of the data to be output and defines any operations to be performed on these variables, and ICOP lists the conversion options or flags the arithmetic operations to be performed on the variables listed in SYMB. An example of an (ISTOR = 2) output phase is illustrated in Figure 3-5

If a desired table requires data from different phases in a case to be output on a single line and table data are required for more than one case, then successive report generator phases of ISTOR = 1 and ISTOR = 2 are executed by employing the TOTCAS and REPEAT variables All data after the TOTCAS input and prior to the REPEAT input will be repeated the number of times that TOTCAS is set. An example of the use of these variables is shown in Figure 3-7.

The remaining variables identified with the output of data are used mainly for comments, headings, paging, line spacing, etc. A list and brief description of the groups of variables that may be specified for certain output options are presented below:

a) NTITLE, NLC, L$(IA), and R$(IA) are input to obtain one or more lines of comment or heading print. NTITLE indicates whether a heading or comment is to be printed. If it is to be printed, NLC defines the number of lines of print, and L$(IA) and R$(IA) specify the left and right halves of the comment or heading, respectively. IA defines the number of the line in the comment or heading. This option may be used in any type report generator phase.

b) PCV, VL$(IA), and VR$(IA) are input to obtain lines of comment when the critical variable equals specific critical values. PCV indicates whether the option is to be used. VL$(IA) and VR$(IA) specify the left and right halves of the comment to be output when the critical variable becomes equal to the IAth value listed in CRITV.

c) LEST, LLIM, and LSPACE are used within the program to maintain a total of the line count per page in order to determine when to begin a new page. LEST contains the number of lines of output generated by the format statement FMT$. LLIM defines the maximum number of lines per page, and LSPACE specifies the spacing between lines of data output.

d) PAGEP, NPG, and SUF specify the printing of a page number and suffix at the top of each page of output. PAGEP is the option which allows the page number and suffix to be printed. NPG is the initial page number and SUF is the character suffix which is printed to the right of the page number. If NPG is set equal to 0, a page eject will occur and NPG will be internally set to 1.

The remaining output options are described in Section 3.2 together with a complete list of all input symbols and their definitions.

3 2 PROGRAM INPUT DEFINITION

A glossary of the inputs and options available in the RTACF Report Generator are presented below. All quantities are input as integer numbers unless otherwise noted. Examples will be included in the definitions, wherever needed, to clarify the use of the variable.

Symbol	Preset Value	Definition
BRS	0.0	Block record skip values. The first value will begin the block record skip (lower bound), the second value will terminate it (upper bound), and the third value will begin the next block record skip (lower bound), etc. When the data become larger than the upper bound, the next set of lower and upper bounds are considered. Block record skip values must be in units which are on the variable format tape. BRS = 1.0, 1.1, 2.0, 2.1 Data will not be generated when the critical variable has values between 1.0 and 1.1 and then between 2.0 and 2.1.
CRITV	0.0	Critical variable values. CRITV must be in units which are on the variable format tape. CRITV = 1.0, 2.0, 3.0, 4.0, 3 0 Generation of data will occur only when the critical variable in the first record is equal to 1.0, the critical variable in the second record is equal to 2.0, the critical variable in the third record is equal to 3.0, etc. If these five points are all that are wanted, input an unattainable number for the sixth point, otherwise, every point after the second 3.0 will be in the report.
ENDFIL		Causes output and end of file to be written on the plot tape
ENDTAB		Word to designate the end of data input for a phase (HOL)
FMT$(IA)	Blank	Format for each variable output. The number IA defines the order in which the individual format entries are to be considered in forming the format statement. IA can have a maximum value of 10. The format starts after the equal sign and includes the next 60 columns. The format statement may contain any format information acceptable to FORTRAN V. Each format statement must begin and end with a parenthesis as shown below:

Symbol	Preset Value	Definition
		FMT$(1) = (F7 2, 1X, ..., 10X, FMT$(2) = F10. 1/20X, F9.4,..., F10. 1) Formats carry over from one phase to another. To delete a previous input FMT$(IA) entry, input FMT$(IA) =
*ICOP	0	Conversion option for each output variable = 0 No conversion = 1 ADD, SUB, MUL, or DIV any variable or constant to form an output variable. Operations are performed from left to right ENDOP must be the last word in a series of arithmetic operations. = 2 Perform one of the following conversions (ICOP options 3 through 16) on the quantity resulting from an ICOP = 1 option = 3 Hours to hr, min, and sec = 4 Hours to min and sec = 5 Seconds to hr, min, and sec = 6 Degrees to deg, min, and sec = 7 Degrees to deg and min = 8 Degrees to hr, min, and sec = 9 Radians to deg, min, and sec = 10 Radians to hr, min, and sec = 11 Feet to n mi = 12 Feet to m = 13 Nautical miles to km = 14 Divide by the acceleration of gravity at sea level (32. 176) = 15 Pounds of force to Newtons = 16 Seconds to min and sec An example of the use of ICOP is shown in Section 3. 1. 2

*In time conversions, hr and min are output as integer quantities and sec is output as a single precision quantity. In angular conversions, deg and min are output as integer quantities and sec is output as a single precision quantity except for ICOP = 7 where min is output as a single precision quantity

Symbol	Preset Value	Definition
IFILE	0	Option to read the report generator input data from a specified tape unit = 0 Read data from tape unit 5. > 0 Read data from tape unit 24 after positioning to the file on this tape which is equal to IFILE. < -1 Not valid = -1 Continue to read data from tape unit 24.
III	0	Option to print the input data = 0 Do not print the input data. ≠ 0 Print the input data.
INCV	0	Index to the critical variable corresponding to the SYMB entry number. This value is required for BRS and CRITV inputs.
ISEQ	-1	Sequencing option. If input zero or positive, a sequence number will be added to the report. ISEQ will be the initial value of the sequence The sequence is incremented by one each time data are written to form a report and will be the last value to be generated Sequencing will carry over from one phase to the next. This option is mainly used to sequence punched cards
ISTOR	0	Option to store data from the variable format tape into an internal array = 0 Normal generated report = 1 Store the data into the internal array = 2 Generate a report using the internal array data.
IVEH	1	Vehicle number of the corresponding variables on the SYMB input = 1 Vehicle 1 data = 2 Vehicle 2 data IVEH = 1, 1, 2, 1, 2 In the above example, the first and second variables specified in SYMB are taken from the first vehicle record, the third variable from the second vehicle record, the fourth variable from the first vehicle record, etc.

Symbol	Preset Value	Definition
LEST	1	Number of lines generated due to the format input FMT$
LLIM	50	Maximum number of lines per page
LSPACE	0	Variable line spacing between data lines = 0 No line spacing = 1 One line space between data lines = N N line spaces between data lines
L$	Blank	Left half of the line in the heading print. See R$ for more information (HOL).
NBRS	0	Number of pairs of block record skip values. Maximum number of values is 40.
NCV	0	Number of critical values input. The maximum number of values is 99.
NDATA	1	Initial location for storing data into an internal array. The array is one dimensional and contains 500 elements. This location is updated internally to the number of the next unused storage location and will carry over to the next phase
NLC	0	Number of lines in the heading print. The maximum number of lines is 20
NPG	0	Initial page number which may be printed at the top of a page. If NPG is set to zero, then a page eject will occur and NPG will be set to one Page numbering will carry over from one report to the next
NTAB	1	Number of reports to be generated It is used primarily for the purpose of placing an end of file on tape unit 17 (microfilm unit).
NTAPE	6	Option to write a report on a specified tape unit = -3 Punch output = 6 Print output. = 17 SC-4020 output (microfilm)

Symbol	Preset Value	Definition
NTITLE	1	Option to print a heading or comment This may include a phase title which is taken off the variable format tape (unit 8) and an input title which is formed by L$ and R$ = 0 Do not print a heading. = 1 Print a heading at the beginning of the report or print one or more comments at the start of a report generator phase = 2 Print a heading at the beginning of the report and at the top of each page
NVAR	0	Number of variables to appear in the phase or to be stored in the internal array. This will usually be the number of variables on the SYMB input.
PAGEP	0	Option to print the page number and suffix at the top of each page = 0 Do not print the page number and suffix ≠ 0 Print the page number and suffix
PCV	0	Option to print the critical comment when the data are generated by critical values = 0 Do not print the critical comment. ≠ 0 Print the critical comment.
PHASE	0	Phase numbers from the variable format tape that are to be processed in a phase PHASE = 3, 4, 5, 2, 9 The data would be taken from phases 3, 4, 5, 2, and 9, in that order. If the phases cannot be found in this order, then an end of file or bad data will be read It is possible to go from phase 5 case 1 to phase 2 case 2. Cases are made with an ENDRUN card when the variable format tape is made.
PHTPR	0	Option to print the phase title from the variable format tape = 0 Do not print the phase title ≠ 0 Print the phase title.

Symbol	Preset Value	Definition
REPEAT		Signifies the end of the input data that is to be repeated according to TOTCAS
REWND	1	Rewind the variable format tape (unit 8) and position it to read the file as specified by REWND. REWND must be input after the first report and for each successive report which needs the variable format tape rewound.
REC$(IA)	1, 77777, 1	Option to read specified phase records on the variable format tape. The input should be as follows REC$(IA) = IB, IC, ID IA < 0 All phases in the IAth and greater positions on the PHASE input will contain the same data IA = 0 Not valid IA > 0 The phase in the IAth position on the PHASE input will be processed with the following data IB ≤ 0 Only data point will be at the end of the phase IB > 0 First data point will be the IBth record. IC ≤ 0 Last data point will be at the end of the phase. IC > 0 Last data point will be the largest record which is less than or equal to the ICth record. ID ≤ 0 Next data point will be at the end of the phase ID > 0 Next data point will be in increments of ID measured from IB An example of the use of REC$ follows. REC$(2) = 1, 20, 3 PHASE = 10, 12, 14 REC$(2) is the record specification for the second phase (12) specified by PHASE. The records that will be processed are 1, 4, 7, 10, 13, 16, 19

Symbol	Preset Value	Definition
R$(IA)	Blank	Right half of the line in the heading or comment print (HOL) L$(IA) = LEFT HALF R$(IA) = RIGHT HALF The number IA is an integer and defines the line in the heading or comment print. The heading starts after the equal sign and contains the next 66 columns. To delete previous heading data, input L$(IA) and R$(IA) as follows: L$(IA) = R$(IA) =
SORT	Blank, Blank	SORT determines in what order a specified data variable is to be written on the output plot tape The first variable gives the name of the variable that will be used to sort the data It must equal one of the names on SYMREC The second variable specifies how to arrange the data. The choices are increasing (INC) and decreasing (DEC). If SORT is set to other than blank, then logical units L and M must be assigned to FASTRAND.
SUF	Blank	Character suffix which is printed to the right of the page number (HOL). Maximum number of six letters may be specified.
SYMB	Blank	Symbol name location of the data, location of the data in the internal array, or operation to be performed on the data which will be output (HOL). 1) SYMB = A, B, C, D, E 2) SYMB = 2, 7, 9, 5 3) SYMB = A, B, ADD, C, MUL, 7.8, SYMB = SUB, E Number 1 shows the method of inputting the variable names for a simple report. Number 2 shows how to take data from the internal array for a report. Number 3 shows how to use conversion option.

Symbol	Preset Value	Definition
SYMREC	Blank	Symbol name to be output on the negative record type of the TRWPLT input tape i. e., the variable names input to SYMREC replace for output plot purposes the names specified by SYMB. ICOP options for time, radians, and degrees (ICOP = 3, 4, 5, 6, 7, 8, 9, 10, and 16) may not be used when generating plot output (HOL).
TOLN	0. 0	Negative tolerance for the critical value (SP)
TOLP	0 0	Positive tolerance for the critical value (SP)
TOTCAS	0	Total number of trajectories to process An example of the use of TOTCAS in conjunction with REPEAT is shown in Section 3. 1. 3.
TOTPHA	0	Total number of phases to be processed for a report generator phase
VL$(IA)	Blank	Left half of the critical value comment (HOL)
VR$(IA)	Blank	Right half of the critical value comment (HOL) VL$(IA) = LEFT HALF VR$(IA) = RIGHT HALF These inputs are like L$ and R$, except that the comment starts after the equal sign and contains the next 60 columns VL$(IA) and VR$(IA) are output when the critical variable becomes equal to the IA^{th} value listed in CRITV.

3.3 SAMPLE CASES

Examples of the report generator input used and the corresponding printed output generated are shown in Figures 3-1 through 3-14

Examples 1 through 4 (Figures 3-1 through 3-8) are discussed in Section 3.1. Examples 5 through 7 (Figures 3-9 through 3-14) depict additional possible data operations. Example 5 indicates the use of the report generator in operating on ARMP data for two vehicles within the same phase. The input is given in Figure 3-9 and the output, in Figure 3-10.

Example 6, presented in Figures 3-11 and 3-12, shows the use of output conversion options. Also, it can be seen that in the case of dual input of a variable, the latter value is used.

Example 7 in Figures 3-13 and 3-14 indicates the use of the report generator to read an ARMP generated VLIST tape and to produce a tape acceptable to TRWPLT.

```
TOTPHA = 5                         * TOTAL NUMBER OF PHASES
PHASE  = 16,17,18,19,20            * PHASES TO BE PROCESSED
III    = 1                         * PRINT INPUT DATA
NTITLE = 2                         * PRINT HEADING ON EVERY PAGE
LSPACE = 0                         * NUMBER OF SPACES
NVAR   = 5                         * NUMBER OF VARIABLES
NLC    = 6                         * NUMBER OF LINES IN HEADER
ICOP   = 5,3,8,6                   * CONVERSION OPTIONS
INCV   = 4                         * CRITICAL VARIABLE
TOLP   = 45.0                      * POSITIVE TOLERANCE
TOLN   = 44.9                      * NEGATIVE TOLERANCE
NCV    = 99                        * NUMBER OF CRITICAL VALUES
CRITV  = 45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.
CRITV  = 45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.
CRITV  = 45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.
CRITV  = 45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.
CRITV  = 45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.,45.
SYMB   = GMTT,T,RATC1,DECTC1,RANGR
L$(1)  =                                                            TELESCOPE T
L$(2)  =                                                                 BUILDI
L$(4)  =                         GMT                      GET                RIG
L$(5)  =                    HRS  MIN   SEC           HRS  MIN   SEC        HRS
R$(1)  =RACKING FOR
R$(2)  =NG 16
R$(4)  =HT ASC            DECLINATION           RANGE
R$(5)  =MIN  SEC         DEG  MIN  SEC           N.M.
FMT$(1)= (19X,4(2I4,F6.1,7X),F10.1)
IFILE  = 0                         * GO BACK TO CARD READER
```

Figure 3-1. Example 1 Report Generator Input

TELESCOPE TRACKING FOR
BUILDING 16

GMT			GET			RIGHT ASC			DECLINATION			RANGE
HRS	MIN	SEC	HRS	MIN	SEC	HRS	MIN	SEC	DEG	MIN	SEC	N.M.
21	17	25.7	4	28	50.4	5	11	2.3	31	42	59.2	16832.0
21	17	25.7	4	28	50.4	5	11	2.3	31	42	59.2	16831.9
22	48	35.3	6	0	.0	6	1	25.9	30	44	10.7	27762.5
22	48	35.3	6	0	.0	6	1	25.9	30	44	10.7	27762.5
26	27	29.9	9	38	54.5	6	45	26.6	28	8	25.8	49570.0
26	27	29.9	9	38	54.5	6	45	26.6	28	8	25.8	49570.0
92	48	35.3	75	59	60.0	6	45	26.6	28	8	25.8	49570.0

Figure 3-2 Report Generated by Example 1

```
 III=1                                           *PRINT INPUT
NPG=0                                            *PAGE EJECT
NLC=12                                           *NUMBER OF LINES OF HEADER
L$(01)=                                             TABLE III.  TYPICAL DSKY PARAME.
L$(02)=                                                        THE APOLL 13 (MISSI
L$(03)=
L$(04)=**********************************************************************
L$(05)=
L$(06)=
L$(07)=
L$(08)= GROUND
L$(09)=ELAPSED     INERTIAL                    ALTITUDE                    PREDICTED
L$(10)=  TIME      VELOCITY    ALTITUDE         RATE       SPLERROR       PERIGEE
L$(11)=(MIN SEC)   (FT/SEC)     (N MI)        (FT/SEC)      (N MI)         (N MI)
R$(01)=TERS DURING LAUNCH FOR
R$(02)=ON H-2)
R$(03)=
R$(04)=***********************************
R$(05)=                       PREDICTED
R$(06)=                        TIME OF
R$(07)=                       FREE FALL
R$(08)=                           TO        PITCH
R$(09)=     PREDICTED           300,000     GIMBAL
R$(10)=       APOGEE              FEET      ANGLE
R$(11)=       (N MI)          (MIN SEC)     (DEG)
NTITLE=2                                         *PRINT TITLE ON EACH PAGE
LSPACE=1                                         *SKIP A LINE BETWEEN DATA LINES
LLIM=37                                          *TOTAL NUMBER OF LINES ON A PAGE
TOTPHA=40                                        *TOTAL PHASES TO PROCESS
PHASE=20,20,20,20,20,20,20,20,20,20,20,20,20,20,20,20,20,20,20,20
PHASE=20,20,20,20,20,20,20,20,20,20,20,20,20,20,20,20,20,20,20,20
NVAR=8                                           *NUMBER OF VARIABLES
ICOP=4,0,11,0,0,0,16,0                           *CONVERSION OPTIONS
SYMB=T,V,ALT,SPERR,RPALT,RAALT,IPT,IGA *VARIABLE TO STORE AND OUTPUT
FMT$(1)=(1H ,I4,F4.0,F12.0,F10.1,10X,2(F13.1),F11.1,9X,I2,F4.0,F8.1)
REC$(-1)=-1                                      *READ VLIST FROM START OF PHASE
 ENDTAB
```

Figure 3-3. Example 2 Report Generator Input

TABLE III. TYPICAL DSKY PARAMETERS DURING LAUNCH FOR
THE APOLL 13 (MISSION H-2)

****

GROUND ELAPSED TIME (MIN SEC)	INERTIAL VELOCITY (FT/SEC)	ALTITUDE (N MI)	ALTITUDE RATE (FT/SEC)	SPLERROR (N MI)	PREDICTED PERIGEE (N MI)	PREDICTED APOGEE (N MI)	PREDICTED TIME OF FREE FALL TO 300,000 FEET (MIN SEC)	PITCH GIMBAL ANGLE (DEG)
5 20.	12517.	83.3		-2590.8	-2968.1	86.7	3 3.	-18.9
5 30.	12838.	84.9		-2558.0	-2938.8	87.8	3 3.	-17.9
5 40.	13171.	86.4		-2523.7	-2907.2	88.8	3 4.	-16.7
5 50.	13518.	87.8		-2487.8	-2873.1	89.8	3 4.	-15.6
6 0.	13878.	89.0		-2450.2	-2836.2	90.7	3 5.	-14.5
6 10.	14252.	90.2		-2410.5	-2796.2	91.5	3 6.	-13.3
6 20.	14641.	91.2		-2368.6	-2752.7	92.3	3 8.	-12.1
6 30.	15046.	92.2		-2324.2	-2705.4	93.0	3 9.	-10.9
6 40.	15467.	93.0		-2276.7	-2653.6	93.6	3 11.	-9.7
6 50.	15905.	93.8		-2225.9	-2596.9	94.2	3 13.	-8.5
7 0.	16361.	94.5		-2171.1	-2534.6	94.8	3 16.	-7.3
7 10.	16836.	95.1		-2111.4	-2465.9	95.3	3 20.	-6.1

Figure 3-4 Report Generated by Example 2

CARD READER INPUT

```
∇ XQT REPORT
IFILE  = 35                          * READ FILE 35 ON TAPE U
TOTPHA = 8                           * EIGHT PHASES OF DATA
IFILE  = -1                          * CONTINUE TO READ TAPE U
ENDTAB                               * PROCESS DATA
IFILE  = -1                          * CONTINUE TO READ TAPE U
ENDTAB                               * PROCESS DATA
IFILE  = -1                          * CONTINUE TO READ TAPE U
ENDTAB                               * PROCESS DATA
IFILE  = -1                          * CONTINUE TO READ TAPE U
ENDTAB                               * PROCESS DATA
∇ EOF
```

DATA TAPE INPUT

```
   * CREW CHART UPDATE - FILE 35 OF DATA TAPE
TOTPHA = 1                           * TOTAL NUMBER OF PHASES
PHASE  = 4                           * PHASE NUMBER TO BE PROCESSED
NLC    = 9                           * NUMBER OF LINES IN HEADER
L$(6)=                                                                     RTA
L$(7)=                                                                 LOI + 3
L$(8)=                                                              CREW CHART
R$(6)=CF
R$(7)=0 MIN
R$(8)= UPDATES
NVAR   = 8                           * NUMBER OF VARIABLES
IVEH   = (6),2,2,2                   * VEHICLE NUMBER
SYMB   = VID11,VID12,VID13,RFID11,RFID12,OGA,IGA,MGA
FMT$(1)= (52X,11HVECTOR ID   ,3A6,/52X,13HREFSMMAT ID   ,2A6,//53X,26H
FMT$(2)=30 MIN ABORT GIMBAL ANGLES,//58X,10HYAW    (O) ,F7.2,/58X,10H
FMT$(3)=PITCH (I) ,F7.2,/58X,10HROLL  (M) ,F7.2)
ENDTAB
ISTOR = 1                            * STORE DATA IN INTERNAL ARRAY
NTITLE = 0                           * DO NOT PRINT HEADER
PHASE  =10,12,10,12,10,12,10,12
NVAR   = 2                           * NUMBER OF VARIABLES
SYMB  = PELTS,DELV                   * VARIABLES TO BE STORED
REC$(-1) = -1                        * PROCESS LAST DATA RECORD
IFILE  = 0                           * READ ADDITIONAL INPUT DATA FROM CARD READER
ENDTAB
ISTOR  = 2                           * OUTPUT DATA FROM INTERNAL STORAGE ARRAY
NTITLE = 1                           * PRINT COMMENTS IN R$ AND L$
NLC    = 4                           * NUMBER OF LINES IN COMMENT
L$(2)=                                                   LOI BURN TIME   LOI DE
L$(3)=                                                     (SECONDS)      (FT/S
R$(2)=LTA-V    ABORT DELTA-V
R$(3)=EC)        (FT/SEC)
NVAR   = 3                           * NUMBER OF VARIABLES OUTPUT
SYMB   = 1,2,4                       * SYMBOLS OUTPUT FROM INTERNAL ARRAY
FMT$(1)= (49X,F5.1,2(8X,F7.1))
FMT$(2)=
FMT$(3)=
IFILE  = 0                           * READ ADDITIONAL INPUT DATA FROM CARD READER
SYMB   = 5,6,8                       * SYMBOLS OUTPUT FROM INTERNAL ARRAY
IFILE  = 0                           * READ ADDITIONAL INPUT DATA FROM CARD READER
SYMB   = 9,10,12                     * SYMBOLS OUTPUT FROM INTERNAL ARRAY
IFILE  = 0                           * READ ADDITIONAL INPUT DATA FROM CARD READER
SYMB   = 13,14,16                    * SYMBOLS OUTPUT FROM INTERNAL ARRAY
IFILE  = 0                           * READ ADDITIONAL INPUT DATA FROM CARD READER
∇ EOF
```

Figure 3-5   Example 3 Report Generator Input

```
              RTACF
          LOI + 30 MIN
      CREW CHART UPDATES

VECTOR ID  INSE 000 CSM    M
REFSMMAT ID  LCV001  CSM

 30 MIN ABORT GIMBAL ANGLES

      YAW   (O)  184.84
      PITCH (I)   90.04
      ROLL  (M)   26.43

LOI BURN TIME    LOI DELTA-V   ABORT DELTA-V
  (SECONDS)       (FT/SEC)       (FT/SEC)

        .0             .0          1840.0
      20.0          137.4          1930.0
      40.0          280.7          2100.0
      60.0          426.1          2325.0
```

Figure 3-6 Report Generated by Example 3

```
NLC=11                               *NUMBER OF LINES OF HEADER
L$(1)=              TABLE IV.- SUMMARY OF NOMINAL MODE II ABORT TRAJECT
L$(2)=                                       (A) ENTRY PARAMETERS
L$(4)=*****************************************************************
L$(5)=                                        INERTIAL   INERTIAL
L$(6)=   GROUND     INERTIAL                  VELOCITY   FLIGHT
L$(7)=   ELAPSED    VELOCITY  MAXIMUM           AT       PATH ANGLE  GEODETIC
L$(8)=   TIME OF       AT      ENTRY         300,000     AT 300,000  LATITUDE
L$(9)=    ABORT      ABORT     LOAD            FEET         FEET     AT LANDING
L$(10)=  (MIN SEC)  (FT/SEC)   FACTOR      (FT/SEC)       (DEG)     (DEG NORTH
R$(1)=ORIES
R$(2)=
R$(4)=***********************
R$(8)=    LONGITUDE  RANGE AT
R$(9)=   AT LANDING  LANDING
R$(10)=)  (DEG WEST)  (N MI)
LSPACE=1                                 *SKIP A LINE BETWEEN DATA LINES
LLIM=37                                  *PHASES TO PROCESS PER CASE
NPG=0                                    *PAGE EJECT
NTITLE=2                                 *PRINT TITLE ON EACH PAGE
TOTPHA=3                                 *TOTAL PHASES TO PROCESS
PHASE=20,90,99                           *PHASES TO PROCESS PER CASE
FMT$(1)=(1X,I6,F4.0,F12.2,9X,F11.2,F10.2,F11.2,F14.2,F11.2)
ICOP=4,0,0,0,0,1                         *CONVERSION OPTIONS
REC$(-1)=1,7777777,7777777777
TOTCAS=40                                *PROCESS 40 CASES
SYMB=T,V,PTH,LAT,LON,CRNGE               *VARIABLES TO STORE
ISTOR=1                                  *STORE THE VARIABLES IN NUMBER ARRAY
NDATA=1                                  *STARTING LOCATION FOR INPUT ARRAY
NVAR=6                                   *NUMBER OF VARIABLES TO STORE
  ENDTAB
ISTOR=2                                  *OUTPUT THE STORED ARRAY
NVAR=7                                   *NUMBER OF VARIABLES TO OUTPUT
SYMB=1,2,8,9,16,360.,SUB,17,ENDOP,18     *OUTPUT FROM STORED ARRAY
  ENDTAB
REPEAT                                   *REPEAT INPUT STARTING FROM TOTCAS
```

Figure 3-7. Example 4 Report Generator Input

TABLE IV.- SUMMARY OF NOMINAL MODE II ABORT TRAJECTORIES
(A) ENTRY PARAMETERS

****

GROUND ELAPSED TIME OF ABORT (MIN SEC)	INERTIAL VELOCITY AT ABORT (FT/SEC)	MAXIMUM ENTRY LOAD FACTOR	INERTIAL VELOCITY AT 300,000 FEET (FT/SEC)	INERTIAL FLIGHT PATH ANGLE AT 300,000 FEET (DEG)	GEODETIC LATITUDE AT LANDING (DEG NORTH)	LONGITUDE AT LANDING (DEG WEST)	RANGE AT LANDING (N MI)
7 40.	18390.71		18884.60	-8.96	32.66	52.47	1471.23
7 42.	18501.85		18990.48	-8.86	32.66	52.11	1489.08
7 50.	18874.08		19357.34	-8.52	32.67	50.84	1553.67
8 0.	19334.10		19810.85	-8.11	32.66	49.02	1645.48
8 10.	19812.71		20283.11	-7.68	32.61	46.97	1749.48
8 20.	20312.34		20776.34	-7.24	32.50	44.63	1868.21
8 30.	20771.83		21230.67	-6.82	32.35	42.25	1989.54
8 40.	21177.44		21632.20	-6.46	32.15	39.93	2107.70
8 50.	21594.43		22044.94	-6.07	31.87	37.28	2243.91
9 0.	22025.15		22471.27	-5.66	31.46	34.21	2402.87
9 10.	22469.75		22911.35	-5.23	30.85	30.55	2594.44
9 19.	22838.65		23276.78	-4.86	30.15	27.00	2783.22
9 19.	22838.87		23280.22	-4.86	30.14	26.96	2785.16

Figure 3-8 Report Generated by Example 4

```
TOTPHA = 1                     * TOTAL NUMBER OF PHASES
PHASE  = 4                     * PHASE NUMBERS TO BE PROCESSED
NTITLE = 2                     * PRINT TITLE ON EACH PAGE
NEC    = 20                    * NUMBER OF HEADER LINES
NVAR   = 10                    * NUMBR OF VARIABLES
IVEH   = 1,1,1,1,1,2,2,2,2,2 * VEHICLE NUMBER
SYMB   = RFID11,RFID12,IGA,MGA,OGA,IGA,MGA,OGA,RFID21,RFID22
L$(4)  =                                                                  RTA
L$(6)  =                                                      DOCKED LM REFSM
L$(8)  =                                                          LM REFSMMAT
L$(11) =                                                 *********
L$(12) =                                                 *       *
L$(13) =                                                 *  CSM  *
L$(14) =                                                 *       *
L$(15) =                                                 *********
L$(18) =                                             IMU GIMBAL ANGLES
L$(19) =                       REFSMMAT ID.   IGA(P)   MGA(Y)   OGA(R)
R$(4)  =CF
R$(6)) =MAT COMPUTATION
R$(8)  =IS COMPUTED
R$(11) =           *********
R$(12) =           *       *
R$(13) =           *  LEM  *
R$(14) =           *       *
R$(15) =           *********
R$(18) =       IMU GIMBAL ANGLES
R$(19) =    IGA(P)   MGA(R)   OGA(Y)   REFSMMAT ID.
FMT$(1)= (22X,2A6,3F9.2,8X,3F9.2,3X,2A6)
ENDTAB
REWND  = 1                     * REWIND VARIABLE TAPE
TOTPHA = 1                     * TOTAL NUMBER OF PHASES
PHASE  = 4                     * PHASE NUMBERS TO BE PROCESSED
NTITLE = 2                     * PRINT TITLE ON EACH PAGE
NVAR   = 9                     * NUMBER OF VARIABLES
IVEH   = 2,2,2,2,2,2,2,2,2     * VEHICLE NUMBER
NLC    = 6                     * NUMBER OF LINES IN HEADING
SYMB   = XIMUX2,XIMUY2,XIMUZ2
SYMB   = YIMUX2,YIMUY2,YIMUZ2
SYMB   = ZIMUX2,ZIMUY2,ZIMUZ2
L$(4)  =
L$(5)  =                                                                    L
L$(6)  =                                                                 REFS
R$(4)  =
R$(5)  =M
R$(6)  =MMAT
FMT$(1)= (47X,3F12.7//)
ENDTAB
  EOF
```

Figure 3-9. Example 5 Report Generator Input

RTACF

DOCKED LM REFSMMAT COMPUTATION

LM REFSMMAT IS COMPUTED

```
*********          *********
*       *          *       *
*  CSM  *          *  LEM  *
*********          *********
```

	CSM IMU GIMBAL ANGLES			LEM IMU GIMBAL ANGLES			
REFSMMAT ID.	IGA (P)	MGA (Y)	OGA (R)	IGA (P)	MGA (R)	OGA (Y)	REFSMMAT ID.
CUR002 CSM	.00	.00	.00	.00	360.00	359.99	

LM
REFSMMAT

-.9505474	.2924601	.1045309
-.2769555	-.9505017	.1408625
.1405535	.1049461	.9844953

Figure 3-10. Report Generated by Example 5

```
TOTPHA = 1                        * TOTAL NUMBER OF PHASES
PHASE  = 1                        * PHASE TO BE PROCESSED
III    = 1                        * PRINT INPUT DATA
LSPACE = 1                        * NUMBER OF SPACES BETWEEN LINES
NTITLE = 2                        * PRINT TITLE ON EACH PAGE
NVAR   = 7                        * NUMBER OF VARIABLES
ICOP   = 3,5,6,6                  * CONVERSION OPTIONS
SYMB   = T,GMTT,LAT,LON,ALTLP,AZ,REVN1
NLC    = 8                        * NUMBER OF HEADER LINES
L$(2)  =                                                                 GROUND
L$(6)  =                            GMT                   GET            AZIMUTH
L$(5)  =                 GET                    GMT                   LAT
L$(6)  =            HRS  MIN  SEC          HRS  MIN  SEC          DEG  MIN  SEC
R$(2)  =TRACK
R$(5)  =              LONG             ALTITUDE     AZIMUTH      REV.
R$(6)  =         DEG  MIN  SEC            NM                     NO.
FMT$(1)= (9X,4(2I4,F6.1,7X),F8.2,7X,F6.2,4X,F6.2)
ENDTAB
```

Figure 3-11. Example 6 Report Generator Input

2

GROUND TRACK

	GET			GMT			LAT			LONG		ALTITUDE	AZIMUTH	REV.
HRS	MIN	SEC	HRS	MIN	SEC	DEG	MIN	SEC	DEG	MIN	SEC	NM		NO.
48	33	60.0	17	22	60.0	0	33	4.3	114	17	5.3	168.55	56.15	.54
48	34	60.0	17	23	60.0	2	46	55.4	117	20	44.7	163.41	56.25	.55
48	35	60.0	17	24	60.0	5	0	35.3	120	25	42.8	158.40	56.48	.56
48	36	60.0	17	25	60.0	7	13	35.3	123	32	35.4	153.55	56.83	.57
48	37	60.0	17	26	60.0	9	25	25.6	126	41	58.6	148.89	57.33	.58
48	38	60.0	17	27	60.0	11	35	35.3	129	54	28.6	144.44	57.95	.58
48	39	60.0	17	28	60.0	13	43	31.9	133	10	41.3	140.21	58.72	.59
48	40	60.0	17	29	60.0	15	48	41.2	136	31	12.2	136.22	59.64	.60
48	41	60.0	17	30	60.0	17	50	27.5	139	56	35.6	132.51	60.70	.61
48	42	60.0	17	31	60.0	19	48	13.0	143	27	24.3	129.07	61.91	.62
48	43	60.0	17	32	60.0	21	41	18.1	147	4	8.3	125.92	63.27	.63
48	44	60.0	17	33	60.0	23	29	1.5	150	47	13.8	123.09	64.79	.64
48	45	60.0	17	34	60.0	25	10	40.4	154	37	2.2	120.58	66.47	.65
48	46	60.0	17	35	60.0	26	45	30.6	158	33	48.1	118.39	68.30	.66
48	47	60.0	17	36	60.0	28	12	47.6	162	37	38.3	116.55	70.29	.68
48	48	60.0	17	37	60.0	29	31	46.6	166	48	29.4	115.04	72.43	.69
48	49	60.0	17	38	60.0	30	41	44.3	171	6	6.8	113.89	74.70	.70
48	50	60.0	17	39	60.0	31	41	59.3	175	30	3.2	113.09	77.10	.71
48	51	60.0	17	40	60.0	32	31	53.8	179	59	38.3	112.65	79.62	.72
48	52	60.0	17	41	60.0	33	10	55.1	-175	26	1.7	112.56	82.23	.74
48	53	60.0	17	42	60.0	33	38	36.3	-170	48	2.0	112.83	84.92	.75

Figure 3-12. Report Generated by Example 6

GROUND TRACK

GET HRS	GET MIN	GET SEC	GMT HRS	GMT MIN	GMT SEC	LAT DEG	LAT MIN	LAT SEC	LONG DEG	LONG MIN	LONG SEC	ALTITUDE NM	AZIMUTH	REV. NO.
48	54	60.0	17	43	60.0	33	54	38.4	-166	7	38.3	113.45	87.65	.76
48	55	60.0	17	44	60.0	33	56	50.5	-161	26	12.5	114.42	90.40	.78
48	56	60.0	17	45	60.0	33	51	10.7	-156	45	10.2	115.73	93.15	.79
48	57	60.0	17	46	60.0	33	31	46.1	-152	5	55.7	117.38	95.87	.80
48	58	60.0	17	47	60.0	33	0	52.6	-147	29	48.3	119.35	98.52	.81
48	59	60.0	17	48	60.0	32	18	53.7	-142	57	59.2	121.65	101.10	.83
49	0	60.0	17	49	60.0	31	26	19.9	-138	31	28.5	124.25	103.57	.84
49	1	60.0	17	50	60.0	30	23	47.2	-134	11	3.6	127.15	105.92	.85
49	2	60.0	17	51	60.0	29	11	55.4	-129	57	18.9	130.33	108.15	.86
49	3	60.0	17	52	60.0	27	51	27.1	-125	50	35.7	133.79	110.22	.87
49	3	60.0	17	52	60.0	27	51	27.1	-125	50	35.7	133.79	110.22	.87

Figure 3-12. Report Generated by Example 6 (Continued)

```
NLC=1                                              *NUMBER OF LINES OF HEADER
FMT$(1)=(3(2X,E15,8))                              *FORMAT STATEMENT
L$(1)=       T20              TFF20                       CRNG99
R$(1)=
NPG=0                                              *PAGE EJECT
NTITLE=2                                           *PRINT TITLE ON EACH PAGE
LLIM=41                                            *TOTAL NUMBER OF LINES ON A PAGE
TOTPHA=2                                           *TOTAL PHASES TO PROCESS
PHASE=20,99                                        *PHASES TO PROCESS
REC$(-1)=1,77777777,77777777                       *READ VLIST AT END OF PHASE
SYMREC=T20,TFF20,CRNG99,ENDLST                     *TRWPLT SYMBOL RECORD VARIABLES
SORT=CRNG99,INC                                    *SORT RANGE INCREASINGLY
TOTCAS=54                                          *PROCESS 54 CASES
ISTOR=1                                            *STORE THE VARIABLES IN NUMBER ARRAY
NDATA=1                                            *STARTING LOCATION FOR INPUT ARRAY
NVAR=3                                             *NUMBER OF VARIABLES TO STORE
SYMB=T,IPT,CRNGE                                   *VARIABLES TO STORE
  ENDTAB
ISTOR=2                                            *OUTPUT THE STORED ARRAY
NVAR=3                                             *NUMBER OF VARIABLES TO OUTPUT
SYMB=1,2,6                                         *OUTPUT FROM STORED ARRAY
  ENDTAB
REPEAT                                             *REPEAT INPUT STARTING FROM TOTCAS
ENDFIL                                             *WRITE TRWPLT TAPE
  ENDTAB
```

Figure 3-13. Example 7 Report Generator Input

T20	TFF20	CRNG99
.55833332-01	.17507097+03	.43014128+03
.58333330-01	.17448199+03	.44886732+03
.61111107-01	.17576702+03	.47169796+03
.63888885-01	.17705873+03	.49531335+03
.66666663-01	.17810052+03	.51958981+03
.69444440-01	.17895661+03	.54459289+03
.72222218-01	.17966495+03	.57037981+03
.74999996-01	.18026743+03	.59703123+03
.77777773-01	.18078302+03	.62460912+03
.80555551-01	.18123973+03	.65317431+03
.83333328-01	.18167021+03	.68281134+03
.86111106-01	.18209951+03	.71361279+03
.88888884-01	.18255601+03	.74568875+03
.91666661-01	.18306540+03	.77916396+03
.94444439-01	.18365607+03	.81418018+03
.97222216-01	.18436117+03	.85090440+03
.99999994-01	.18521664+03	.88953663+03
.10277777+00	.18626262+03	.93030967+03
.10555555+00	.18754848+03	.97350530+03
.10833333+00	.18913256+03	.10194602+04
.11111110+00	.19108315+03	.10685860+04
.11388888+00	.19348610+03	.11214328+04
.11666666+00	.19644551+03	.11786533+04
.11944444+00	.20009753+03	.12410241+04
.12222221+00	.20461884+03	.13095815+04
.12499999+00	.21024318+03	.13856989+04
.12777777+00	.21729325+03	.14712331+04
.12833333+00	.21891114+03	.14890785+04
.13055554+00	.22348777+03	.15536716+04
.13333333+00	.23210842+03	.16454761+04
.13611110+00	.24281614+03	.17494812+04
.13888888+00	.25583913+03	.18682133+04
.14166667+00	.26896328+03	.19895428+04
.14444444+00	.28105122+03	.21076972+04
.14722222+00	.29636250+03	.22439120+04
.14999999+00	.31555969+03	.24028672+04
.15277776+00	.34068499+03	.25944370+04
.15518653+00	.36682542+03	.27832180+04
.15523514+00	.36668450+03	.27851589+04

Figure 3-14 Output Generated by Example 7
(a) Standard Output Data

T20	TFF20	CRNG99
.15555555+00	.36559048+03	.27792283+04
.15607542+00	.36382035+03	.27797691+04
.15676986+00	.36292514+03	.27885227+04
.15833332+00	.36704464+03	.28413745+04
.16111110+00	.37521722+03	.29421238+04
.16388889+00	.38480432+03	.30518332+04
.16666666+00	.39609146+03	.31720895+04
.16944444+00	.40965536+03	.33059894+04
.17222221+00	.42613148+03	.34569532+04
.17500000+00	.44663292+03	.36309312+04
.17777777+00	.47262228+03	.38355860+04
.18055555+00	.50665265+03	.40840413+04
.18333332+00	.55316478+03	.43993376+04
.18611111+00	.62082101+03	.48255554+04
.18888888+00	.72740822+03	.54540889+04

Figure 3-14. Output Generated by Example 7
(a) Standard Output Data (Continued)

1	3	.55833-01	.17507+03	.43014+03
1	3	.58333-01	.17448+03	.44887+03
1	3	.61111-01	.17577+03	.47170+03
1	3	.63889-01	.17706+03	.49531+03
1	3	.66667-01	.17810+03	.51959+03
1	3	.69444-01	.17896+03	.54459+03
1	3	.72222-01	.17966+03	.57038+03
1	3	.75000-01	.18027+03	.59703+03
1	3	.77778-01	.18078+03	.62461+03
1	3	.80556-01	.18124+03	.65317+03
1	3	.83333-01	.18167+03	.68281+03
1	3	.86111-01	.18210+03	.71361+03
1	3	.88889-01	.18256+03	.74569+03
1	3	.91667-01	.18307+03	.77916+03
1	3	.94444-01	.18366+03	.81418+03
1	3	.97222-01	.18436+03	.85090+03
1	3	.10000+00	.18522+03	.88954+03
1	3	.10278+00	.18626+03	.93031+03
1	3	.10556+00	.18755+03	.97351+03
1	3	.10833+00	.18913+03	.10195+04
1	3	.11111+00	.19108+03	.10686+04
1	3	.11389+00	.19349+03	.11214+04
1	3	.11667+00	.19645+03	.11787+04
1	3	.11944+00	.20010+03	.12410+04
1	3	.12222+00	.20462+03	.13096+04
1	3	.12500+00	.21024+03	.13857+04
1	3	.12778+00	.21729+03	.14712+04
1	3	.12833+00	.21891+03	.14891+04
1	3	.13056+00	.22349+03	.15537+04
1	3	.13333+00	.23211+03	.16455+04
1	3	.13611+00	.24282+03	.17495+04
1	3	.13889+00	.25584+03	.18682+04
1	3	.14167+00	.26896+03	.19895+04
1	3	.14444+00	.28105+03	.21077+04
1	3	.14722+00	.29636+03	.22439+04
1	3	.15000+00	.31556+03	.24029+04
1	3	.15278+00	.34068+03	.25944+04
1	3	.15556+00	.36559+03	.27792+04
1	3	.15608+00	.36382+03	.27798+04
1	3	.15519+00	.36683+03	.27832+04

Figure 3-14. Output Generated by Example 7 (Continued)
(b) Listing of Output Tape Data

1	3	.15524+00	.36668+03	.27852+04
1	3	.15677+00	.36293+03	.27885+04
1	3	.15833+00	.36704+03	.28414+04
1	3	.16111+00	.37522+03	.29421+04
1	3	.16389+00	.38480+03	.30518+04
1	3	.16667+00	.39609+03	.31721+04
1	3	.16944+00	.40966+03	.33060+04
1	3	.17222+00	.42613+03	.34570+04
1	3	.17500+00	.44663+03	.36309+04
1	3	.17778+00	.47262+03	.38356+04
1	3	.18056+00	.50665+03	.40840+04
1	3	.18333+00	.55316+03	.43993+04
1	3	.18611+00	.62082+03	.48256+04
1	3	.18889+00	.72741+03	.54541+04

Figure 3-14. Output Generated by Example 7
(b) Listing of Output Tape Data (Continued)

4. MSFC LAUNCH TAPE PROCESSING

Figure 4-1 illustrates the MSFC launch tape processing flow diagram. It represents the general order of activities that are executed in the preparation of launch abort documentation. The first step is to receive the MSFC launch tape number from MSC and copy this tape using the TRWDMP program (Reference 8) Besides the copied tape, a printout of any records that have copy errors will be produced. These are properly noted, and a new tape can be generated deleting those records that are in error

The insertion record that is used for the wedge angle calculations in PNCH08 is derived by running a short span of data with PNCH08. Using the insertion vector and MSFC tape, PNCH08 is again employed to provide a number of outputs It generates the TRWPLT input tape and merges this tape with any other TRWPLT tape from which data will be utilized in preparation of plotted output. Appendix C shows the format of the generated TRWPLT input tape The data written on the TRWPLT tape are also printed. Punched vector cards at specified times, in a format compatible with the ARMP, are produced. Finally, data are output in any specified format to be used for publication. An example of this is shown in Figure 2-7.

Then, TRWPLT is run from the merged TRWPLT input tape to produce any desired plots in publishable size and form A typical example of the inputs to TRWPLT to process the merged tape is shown in Figure 4-2 and the plot produced is shown in Figure 4-3. Additional information on the TRWPLT program may be obtained from Reference 5

Next, ARMP program is used to generate any trajectory related abort parameter, and the ARMP VLIST option is employed. This option generates a VLIST output tape of selected parameters. Since the ARMP executions are usually time consuming, it is impractical to generate all the desired data for a plot or table in one run. Therefore, there will be several VLIST output tapes that are combined using the TRWDMP program. After combining the tapes the Report Generator Program is used to generate tables and plot tapes as shown in Figures 3-4, 3-8, and 3-14.

TRWPLT is again employed to plot the data generated by the Report Generator. An example of the inputs to TRWPLT to plot the data is shown in Figure 4-4 and the plot in Figure 4-5

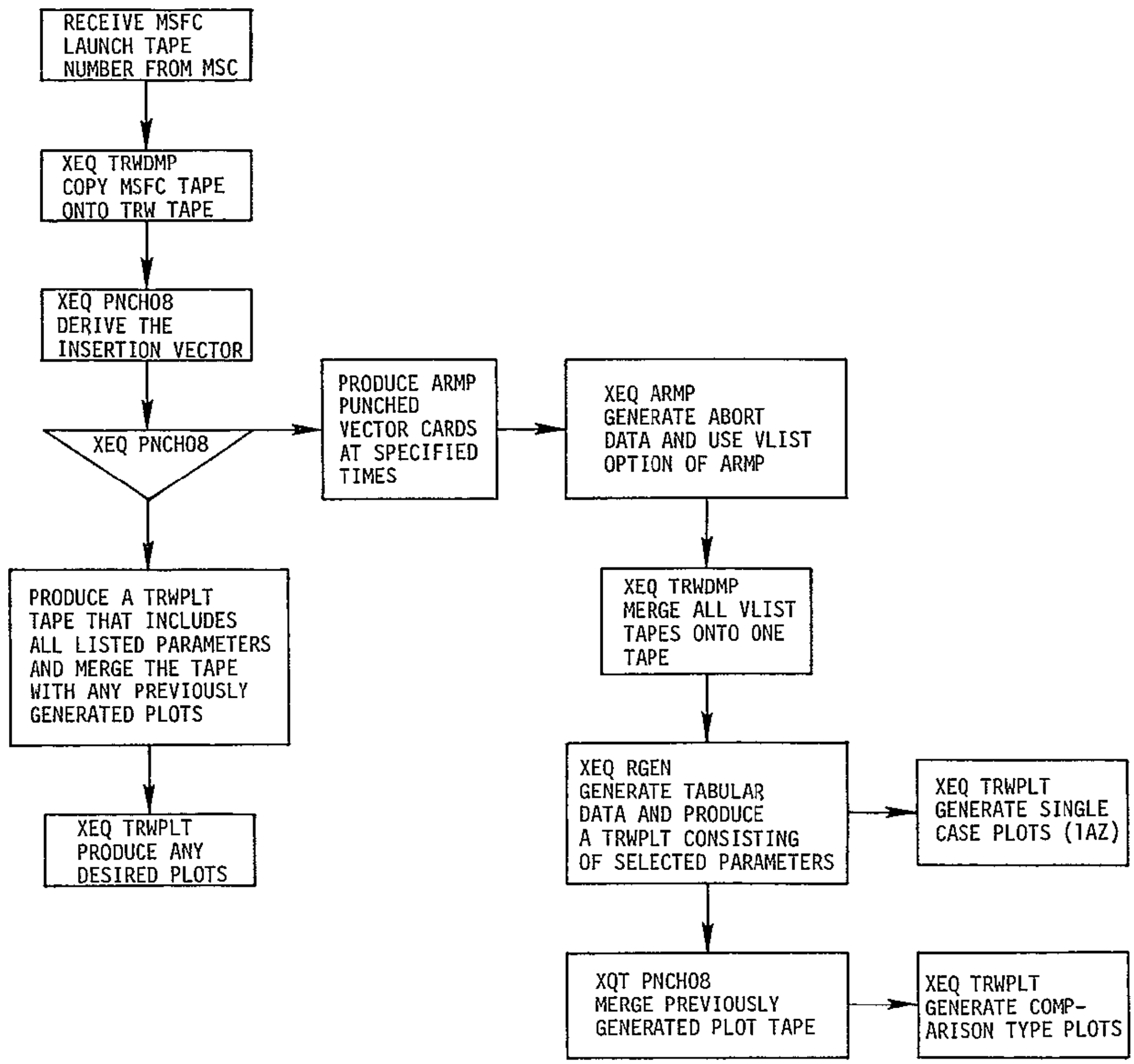


Figure 4-1 MSFC Launch Tape Processing for Launch Aborts

```
 ASG F=XXXXX                                TRWPLT INPUT TAPE
 ASG X=XXXXX                                TRWPLT PCF TAPE
 ASG P=CCP1                                 CALCOM PLOT TAPE
 ASG G=G                                    CARDS PROCESSOR OUTPUT TAPE
 XQT CUR                                    EXECUTE THE FOLLOWING INSTRUCTIONS
 TRW F,X,P,G                                REWIND UNIT F,X,P, AND G
 IN X                                       INPUT THE ENTIRE PCF FROM UNIT X
 TRI X                                      REWIND AND INTERLOCK UNIT X
 XQT CARDS                                  EXECUTE THE CARDS PROCESSOR
KUNIT=9                                    *GENERATE DATA ON UNIT G
SYMB=1,LVBRKX,LVBRKY,ENDLST                *LAUNCH VEHICLE BREAKUP LINE
SYMB=2,HEAT-X,HEAT-Y,ENDLST                *LAUNCH VEHICLE HEATING LIMIT LINE
SYMB=3,S3CNRX,S3CNRY,ENDLST                *SCALE III CORNERS
SYMB=4,G-NOGX,G-NOGY,ENDLST                *
SYMB=5,APOKKX,APOKKY,ENDLST                *APOGEE KICK LINE (5 MIN TO APOGEE)
SYMB=6,OVRSPX,OVRSPY,ENDLST                *OVERSPEED LINE (APOGEE=200 N MI)
SYMB=7,COIBXX,COIBXY,ENDLST                *COI BOUNDARY (125 SEC UNBIASED)
SYMB=8,IMP93X,IMP93Y,ENDLST                *TWO IMPULSE (H=93 N MI)
SYMB=9,IM103X,IM103Y,ENDLST                *TWO IMPULSE (H=103 N MI)
SYMB=10,IM113X,IM113Y,ENDLST               *TWO IMPULSE (H=113 N MI)
SYMB=11,HTS2-X,HTS2-Y,ENDLST               *SCALE II HEATING LIMIT
SYMB=12,HX,HY1,HY2,HY3,HY4,HY5,HY6,        *VARIABLE NAMES OF THE GRID LINES
HY7,HY8,VY,VX1,VX2,VX3,VX4,VX5,            *H STANDS FOR HORIZONTAL LINES AND
VX6,ENDLST                                 *V IS FOR THE VERTICLE LINES
DATA=1,2.540,6.00                          *LAUNCH VEHICLE BREAKUP LINE
DATA=1,2.625,8.00                          *LAUNCH VEHICLE BREAKUP LINE
DATA=1,2.710,10.00                         *LAUNCH VEHICLE BREAKUP LINE
DATA=1,2.795,12.00                         *LAUNCH VEHICLE BREAKUP LINE
DATA=1,2.850,13.00                         *LAUNCH VEHICLE BREAKUP LINE
DATA=1,2.875,13.50                         *LAUNCH VEHICLE BREAKUP LINE
DATA=1,2.895,13.75                         *LAUNCH VEHICLE BREAKUP LINE
DATA=1,2.910,14.00                         *LAUNCH VEHICLE BREAKUP LINE
DATA=1,2.940,14.25                         *LAUNCH VEHICLE BREAKUP LINE
DATA=1,2.950,14.50                         *LAUNCH VEHICLE BREAKUP LINE
```

Figure 4-2. Example 1 TRWPLT Input

```
DATA=1,2.990,14.75                    *LAUNCH VEHICLE BREAKUP LINE
DATA=1,3.025,15.00                    *LAUNCH VEHICLE BREAKUP LINE
DATA=1,3.080,15.05                    *LAUNCH VEHICLE BREAKUP LINE
DATA=1,3.110,15.10                    *LAUNCH VEHICLE BREAKUP LINE
DATA=1,3.150,15.12                    *LAUNCH VEHICLE BREAKUP LINE
DATA=1,3.175,15.12                    *LAUNCH VEHICLE BREAKUP LINE
DATA=1,3.210,15.12                    *LAUNCH VEHICLE BREAKUP LINE
DATA=1,3.240,15.05                    *LAUNCH VEHICLE BREAKUP LINE
DATA=1,3.295,15.00                    *LAUNCH VEHICLE BREAKUP LINE
DATA=1,3.350,14.87                    *LAUNCH VEHICLE BREAKUP LINE
DATA=1,3.400,14.70                    *LAUNCH VEHICLE BREAKUP LINE
DATA=1,3.500,14.40                    *LAUNCH VEHICLE BREAKUP LINE
DATA=1,3.600,14.00                    *LAUNCH VEHICLE BREAKUP LINE
DATA=1,3.750,13.50                    *LAUNCH VEHICLE BREAKUP LINE
DATA=1,3.940,12.75                    *LAUNCH VEHICLE BREAKUP LINE
DATA=1,4.000,12.50                    *LAUNCH VEHICLE BREAKUP LINE
DATA=1,4.150,12.00                    *LAUNCH VEHICLE BREAKUP LINE
DATA=1,4.340,11.30                    *LAUNCH VEHICLE BREAKUP LINE
DATA=1,4.575,10.60                    *LAUNCH VEHICLE BREAKUP LINE
DATA=1,4.800,9.90                     *LAUNCH VEHICLE BREAKUP LINE
DATA=1,5.000,9.20                     *LAUNCH VEHICLE BREAKUP LINE
DATA=1,5.140,8.60                     *LAUNCH VEHICLE BREAKUP LINE
DATA=1,5.240,8.12                     *LAUNCH VEHICLE BREAKUP LINE
DATA=1,5.280,7.75                     *LAUNCH VEHICLE BREAKUP LINE
DATA=1,5.340,7.37                     *LAUNCH VEHICLE BREAKUP LINE
DATA=1,5.400,6.90                     *LAUNCH VEHICLE BREAKUP LINE
DATA=1,5.500,6.10                     *LAUNCH VEHICLE BREAKUP LINE
DATA=2,2.990,14.75                    *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=2,3.025,15.00                    *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=2,3.060,15.25                    *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=2,3.110,15.50                    *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=2,3.175,15.75                    *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=2,3.250,16.00                    *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=2,3.312,16.25                    *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=2,3.412,16.50                    *LAUNCH VEHICLE HEATING LIMIT LINE
```

Figure 4-2 Example 1 TRWPLT Input (Continued)

```
DATA=2,3.500,16.75          *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=2,3.625,17.00          *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=2,3.810,17.20          *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=2,3.900,17.25          *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=2,4.000,17.30          *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=2,4.110,17.37          *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=2,4.210,17.37          *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=2,4.300,17.30          *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=2,4.470,17.25          *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=2,4.650,17.10          *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=2,4.800,16.87          *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=2,5.000,16.62          *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=2,5.150,16.40          *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=2,5.275,16.30          *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=2,5.375,16.25          *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=2,5.500,16.20          *LAUNCH VEHICLE HEATING LIMIT LINE
DATA=3,5.325,15.00          *SCALE III CORNERS
DATA=3,5.325,12.00          *SCALE III CORNERS
DATA=3,6.000,12.00          *SCALE III CORNERS
DATA=3,6.000,8.00           *SCALE III CORNERS
DATA=3,5.325,8.00           *SCALE III CORNERS
DATA=3,5.325,5.00           *SCALE III CORNERS
DATA=4,6.000,39.25          *GO/NO GO LINE
DATA=4,5.850,37.75          *GO/NO GO LINE
DATA=4,5.710,36.25          *GO/NO GO LINE
DATA=4,5.625,35.25          *GO/NO GO LINE
DATA=4,5.540,34.25          *GO/NO GO LINE
DATA=4,5.425,32.62          *GO/NO GO LINE
DATA=4,5.340,31.37          *GO/NO GO LINE
DATA=4,5.250,29.75          *GO/NO GO LINE
DATA=4,5.200,28.75          *GO/NO GO LINE
DATA=4,5.175,28.35          *GO/NO GO LINE
DATA=4,5.150,27.50          *GO/NO GO LINE
DATA=4,5.105,26.25          *GO/NO GO LINE
DATA=4,5.075,24.75          *GO/NO GO LINE
```

Figure 4-2 Example 1 TRWPLT Input (Continued)

```
DATA=4,5.050,23.25                 *GO/NO GO LINE
DATA=4,5.030,22.00                 *GO/NO GO LINE
DATA=4,5.025,20.75                 *GO/NO GO LINE
DATA=4,5.025,20.50                 *GO/NO GO LINE
DATA=4,5.025,20.00                 *GO/NO GO LINE
DATA=4,5.030,19.00                 *GO/NO GO LINE
DATA=4,5.035,18.00                 *GO/NO GO LINE
DATA=4,5.050,17.00                 *GO/NO GO LINE
DATA=4,5.065,15.50                 *GO/NO GO LINE
DATA=4,5.100,14.50                 *GO/NO GO LINE
DATA=4,5.120,13.25                 *GO/NO GO LINE
DATA=4,5.190,11.50                 *GO/NO GO LINE
DATA=4,5.250,10.25                 *GO/NO GO LINE
DATA=4,5.310,9.00                  *GO/NO GO LINE
DATA=4,5.400,7.75                  *GO/NO GO LINE
DATA=4,5.500,6.25                  *GO/NO GO LINE
DATA=4,5.590,5.25                  *GO/NO GO LINE
DATA=4,5.700,3.75                  *GO/NO GO LINE
DATA=4,5.825,2.50                  *GO/NO GO LINE
DATA=4,6.000,0.75                  *GO/NO GO LINE
DATA=5,3.900,40.0                  *APOGEE KICK LINE (5 MIN TO APOGEE)
DATA=5,4.540,28.75                 *APOGEE KICK LINE (5 MIN TO APOGEE)
DATA=5,5.025,20.50                 *APOGEE KICK LINE (5 MIN TO APOGEE)
DATA=6,5.175,28.35                 *OVERSPEED LINE (APOGEE=200 N MI)
DATA=6,5.210,26.25                 *OVERSPEED LINE (APOGEE=200 N MI)
DATA=6,5.220,25.00                 *OVERSPEED LINE (APOGEE=200 N MI)
DATA=6,5.230,23.50                 *OVERSPEED LINE (APOGEE=200 N MI)
DATA=6,5.240,21.25                 *OVERSPEED LINE (APOGEE=200 N MI)
DATA=6,5.230,17.50                 *OVERSPEED LINE (APOGEE=200 N MI)
DATA=6,5.220,15.00                 *OVERSPEED LINE (APOGEE=200 N MI)
DATA=6,5.200,13.00                 *OVERSPEED LINE (APOGEE=200 N MI)
DATA=6,5.190,11.50                 *OVERSPEED LINE (APOGEE=200 N MI)
DATA=7,5.055,37.50                 *COI BOUNDARY (125 SEC UNBIASED)
DATA=7,4.850,36.00                 *COI BOUNDARY (125 SEC UNBIASED)
DATA=7,4.710,35.05                 *COI BOUNDARY (125 SEC UNBIASED)
```

Figure 4-2 Example 1 TRWPLT Input (Continued)

```
DATA=7,4.510,33.50                    *COI BOUNDARY (125 SEC UNBIASED)
DATA=7,4.225,31.00                    *COI BOUNDARY (125 SEC UNBIASED)
DATA=7,4.000,29.00                    *COI BOUNDARY (125 SEC UNBIASED)
DATA=7,3.710,26.30                    *COI BOUNDARY (125 SEC UNBIASED)
DATA=7,3.425,23.25                    *COI BOUNDARY (125 SEC UNBIASED)
DATA=7,2.937,17.50                    *COI BOUNDARY (125 SEC UNBIASED)
DATA=7,3.150,15.50                    *COI BOUNDARY (125 SEC UNBIASED)
DATA=7,3.430,13.00                    *COI BOUNDARY (125 SEC UNBIASED)
DATA=7,3.675,10.87                    *COI BOUNDARY (125 SEC UNBIASED)
DATA=7,4.000,8.25                     *COI BOUNDARY (125 SEC UNBIASED)
DATA=7,4.455,5.00                     *COI BOUNDARY (125 SEC UNBIASED)
DATA=7,4.825,2.50                     *COI BOUNDARY (125 SEC UNBIASED)
DATA=7,5.055,1.00                     *COI BOUNDARY (125 SEC UNBIASED)
DATA=7,4.000,8.25                     *COI BOUNDARY (125 SEC UNBIASED H=75)
DATA=7,4.455,5.00                     *COI BOUNDARY (125 SEC UNBIASED H=75)
DATA=7,4.825,2.50                     *COI BOUNDARY (125 SEC UNBIASED H=75)
DATA=7,5.055,1.00                     *COI BOUNDARY(125 SEC/UNBSD/H=75)
DATA=7,5.055,37.50                    *COI BOUNDARY(125 SEC/UNBSD/H=75)
DATA=8,0.575,40.0                     *TWO IMPULSE (H=93 N MI)
DATA=8,1.080,35.0                     *TWO IMPULSE (H=93 N MI)
DATA=8,1.600,30.0                     *TWO IMPULSE (H=93 N MI)
DATA=8,2.100,25.0                     *TWO IMPULSE (H=93 N MI)
DATA=8,2.500,21.25                    *TWO IMPULSE (H=93 N MI)
DATA=8,2.775,18.75                    *TWO IMPULSE (H=93 N MI)
DATA=8,3.075,16.25                    *TWO IMPULSE (H=93 N MI)
DATA=8,3.400,13.75                    *TWO IMPULSE (H=93 N MI)
DATA=8,3.550,12.50                    *TWO IMPULSE (H=93 N MI)
DATA=8,3.800,11.00                    *TWO IMPULSE (H=93 N MI)
DATA=8,4.050,9.50                     *TWO IMPULSE (H=93 N MI)
DATA=8,4.400,7.50                     *TWO IMPULSE (H=93 N MI)
DATA=8,4.725,5.75                     *TWO IMPULSE (H=93 N MI)
DATA=8,5.050,4.00                     *TWO IMPULSE (H=93 N MI)
DATA=9,0.500,37.00                    *TWO IMPULSE (H=103 N MI)
DATA=9,1.000,31.70                    *TWO IMPULSE (H=103 N MI)
DATA=9,1.640,25.00                    *TWO IMPULSE (H=103 N MI)
```

Figure 4-2 Example 1 TRWPLT Input (Continued)

```
 DATA=9,2.100,20.00                          *TWO IMPULSE (H=103 N MI)
 DATA=9,2.350,17.50                          *TWO IMPULSE (H=103 N MI)
 DATA=9,2.625,15.00                          *TWO IMPULSE (H=103 N MI)
 DATA=9,2.860,12.75                          *TWO IMPULSE (H=103 N MI)
 DATA=9,3.000,11.50                          *TWO IMPULSE (H=103 N MI)
 DATA=9,3.200,10.0                           *TWO IMPULSE (H=103 N MI)
 DATA=9,4.000,4.20                           *TWO IMPULSE (H=103 N MI)
 DATA=9,4.250,2.50                           *TWO IMPULSE (H=103 N MI)
 DATA=9,4.625,0.00                           *TWO IMPULSE (H=103 N MI)
 DATA=10,0.500,32.62                         *TWO IMPULSE (H=113 N MI)
 DATA=10,0.750,30.00                         *TWO IMPULSE (H=113 N MI)
 DATA=10,1.000,27.25                         *TWO IMPULSE (H=113 N MI)
 DATA=10,1.675,20.00                         *TWO IMPULSE (H=113 N MI)
 DATA=10,2.150,15.00                         *TWO IMPULSE (H=113 N MI)
 DATA=10,2.650,10.00                         *TWO IMPULSE (H=113 N MI)
 DATA=10,2.860,8.00                          *TWO IMPULSE (H=113 N MI)
 DATA=10,3.000,6.75                          *TWO IMPULSE (H=113 N MI)
 DATA=10,3.200,5.00                          *TWO IMPULSE (H=113 N MI)
 DATA=10,3.520,2.50                          *TWO IMPULSE (H=113 N MI)
 DATA=10,3.840,0.00                          *TWO IMPULSE (H=113 N MI)
 DATA=11,0.150,26.20                         *SCALE II HEATING LIMIT
 DATA=11,0.340,26.25                         *SCALE II HEATING LIMIT
 DATA=11,0.425,26.32                         *SCALE II HEATING LIMIT
 DATA=11,0.500,26.50                         *SCALE II HEATING LIMIT
 DATA=11,0.575,26.87                         *SCALE II HEATING LIMIT
 DATA=11,0.675,27.45                         *SCALE II HEATING LIMIT
 DATA=11,0.740,27.70                         *SCALE II HEATING LIMIT
 DATA=11,0.800,27.80                         *SCALE II HEATING LIMIT
 DATA=12,0.,5.,10.,15.,20.,25.,30.,35.,40.,0.,1.,2.,3.,4.,5.,6.
 DATA=12,6.,5.,10.,15.,20.,25.,30.,35.,40.,40.,1.,2.,3.,4.,5.,6.
 ENDFIL
ENDRUN
  XQT TRWPLT
 KUNIT=9                                     *PLOT DATA FROM UNIT 9
 IPRINT=10                                   *PRINT THE FIRST TEN POINTS TO BE PLOTTE
```

Figure 4-2. Example 1 TRWPLT Input (Continued)

```
 ICCOMP=1                                   *GENERATE CALCOMP PLOTS
 PPNM=4.                                    *GRID SELECTION
 TITLE=ID=FIGURE 1.  INERTIAL FLIGHT PATH ANGLE VERSUS INERTIAL VELOCITY (   -V )
 XLABEL=ID=                                     INERTIAL VELOCITY, V  (FT/SEC)
 YLABEL=ID=                                INERTIAL FLIGHT PATH ANGLE,    (DEG)
 NOFSCL=1                                   *SUPPRESS PLOTTING OFF-SCALE POINTS
 ISCALX=1                                   *USE INPUT LIMITS FOR ABSCISSA
 ISCALY=1,1,1,1,1,1,1,1                     *USE INPUT LIMITS FOR ORDINATE
 IFREQ=1,1,1,1,1,1,1,1                      *PLOT EVERY POINT
 CCHAR=0,0,0,0,0,0,0,0                      *GENERATE A LINE PLOT
 XLO=0.,DELX=.76190476,XHI=6.               *ABSCISSA SCALE
 YLO=0.,0.,0.,0.,0.,0.,0.,0.                *ORDINATE SCALE-SETTING UP THE 8
 DELY=6.6666666,6.6666666,6.6666666         *Y SCALES ENABLES PLOTTING THE
 DELY(4)=6.6666666,6.6666666,6.6666666      *HORIZONTAL GRID LINES IN ONE
 DELY(7)=6.6666666,6.6666666                *TRWPLT PHASE
 YHI=40.,40.,40.,40.,40.,40.,40.,40.        *
 PLOT=HX,12,HY1,12,HY2,12,HY3,12,HY4,       *VARIABLES TO BE PLOTTED (PRO-
 12,HY5,12,HY6,12,HY7,12,HY8,12,ENDLST      *DUCES THE HORIZONTAL GRID LINES
ENDPLT
 NOADV=1                                    *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=VX1,12,VY,12,ENDLST                   *1ST VERTICLE GRID LINE
ENDPLT
 NOADV=1                                    *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=VX2,12,VY,12,ENDLST                   *2ND VERTICLE GRID LINE
ENDPLT
 NOADV=1                                    *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=VX3,12,VY,12,ENDLST                   *3RD VERTICLE GRID LINE
ENDPLT
 NOADV=1                                    *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=VX4,12,VY,12,ENDLST                   *4TH VERTICLE GRID LINE
ENDPLT
 NOADV=1                                    *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=VX5,12,VY,12,ENDLST                   *5TH VERTICLE GRID LINE
ENDPLT
 NOADV=1                                    *PLOT TRACE ON PREVIOUS GRAPH
```

Figure 4-2 Example 1 TRWPLT Input (Continued)

```
 PLOT=VX6,12,VY,12,ENDLST                  *6TH VERTICLE GRID LINE
ENDPLT
 NOADV=1                                   *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=LVBRKX,1,LVBRKY,1,ENDLST             *VARIABLES TO BE PLOTTED
ENDPLT
 NOADV=1                                   *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=HEAT-X,2,HEAT-Y,2,ENDLST             *VARIABLES TO BE PLOTTED
ENDPLT
 NOADV=1                                   *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=S3CNRX,3,S3CNRY,3,ENDLST             *VARIABLES TO BE PLOTTED
ENDPLT
 NOADV=1                                   *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=G-NOGX,4,G-NOGY,4,ENDLST             *VARIABLES TO BE PLOTTED
ENDPLT
 NOADV=1                                   *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=APOKKX,5,APOKKY,5,ENDLST             *VARIABLES TO BE PLOTTED
ENDPLT
 NOADV=1                                   *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=OVRSPX,6,OVRSPY,6,ENDLST             *VARIABLES TO BE PLOTTED
ENDPLT
 NOADV=1                                   *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=COIBXX,7,COIBXY,7,ENDLST             *VARIABLES TO BE PLOTTED
ENDPLT
 NOADV=1                                   *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=IMP93X,8,IMP93Y,8,ENDLST             *VARIABLES TO BE PLOTTED
ENDPLT
 NOADV=1                                   *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=IM103X,9,IM103Y,9,ENDLST             *VARIABLES TO BE PLOTTED
ENDPLT
 NOADV=1                                   *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=IM113X,10,IM113Y,10,ENDLST           *VARIABLES TO BE PLOTTED
ENDPLT
 NOADV=1                                   *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=HTS2-X,11,HTS2-Y,11,ENDLST           *VARIABLES TO BE PLOTTED
 LINGER=1                                  *PLOT THE NEXT FILE ON SAME PLOT
```

Figure 4-2 Example 1 TRWPLT Input (Continued)

```
ENDPLT
ENDFIL
 KUNIT=8                                  *PLOT DATA FROM UNIT 8
 NOADV=1                                  *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=VELO,1,GAMA,1,ENDLST                *VARIABLES TO BE PLOTTED
 CMULT=1.E-03                             *MULTIPLICATION FACTOR
ENDPLT
 NOADV=1                                  *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=VELO,1,GAMA,1,ENDLST                *VARIABLES TO BE PLOTTED
 CMULT=.33333333E-03                      *MULTIPLICATION FACTOR
 CADD=-1.6666666,10.                      *ADDITION FACTOR
ENDPLT
 NOADV=1                                  *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=VELO,1,GAMA,1,ENDLST                *VARIABLES TO BE PLOTTED
 CMULT=1.E-03,10.                         *MULTIPLICATION FACTOR
 CADD=-20.5,20.                           *ADDITION FACTOR
ENDPLT
ENDFIL
ENDRUN
```

Figure 4-2 Example 1 TRWPLT Input (Continued)

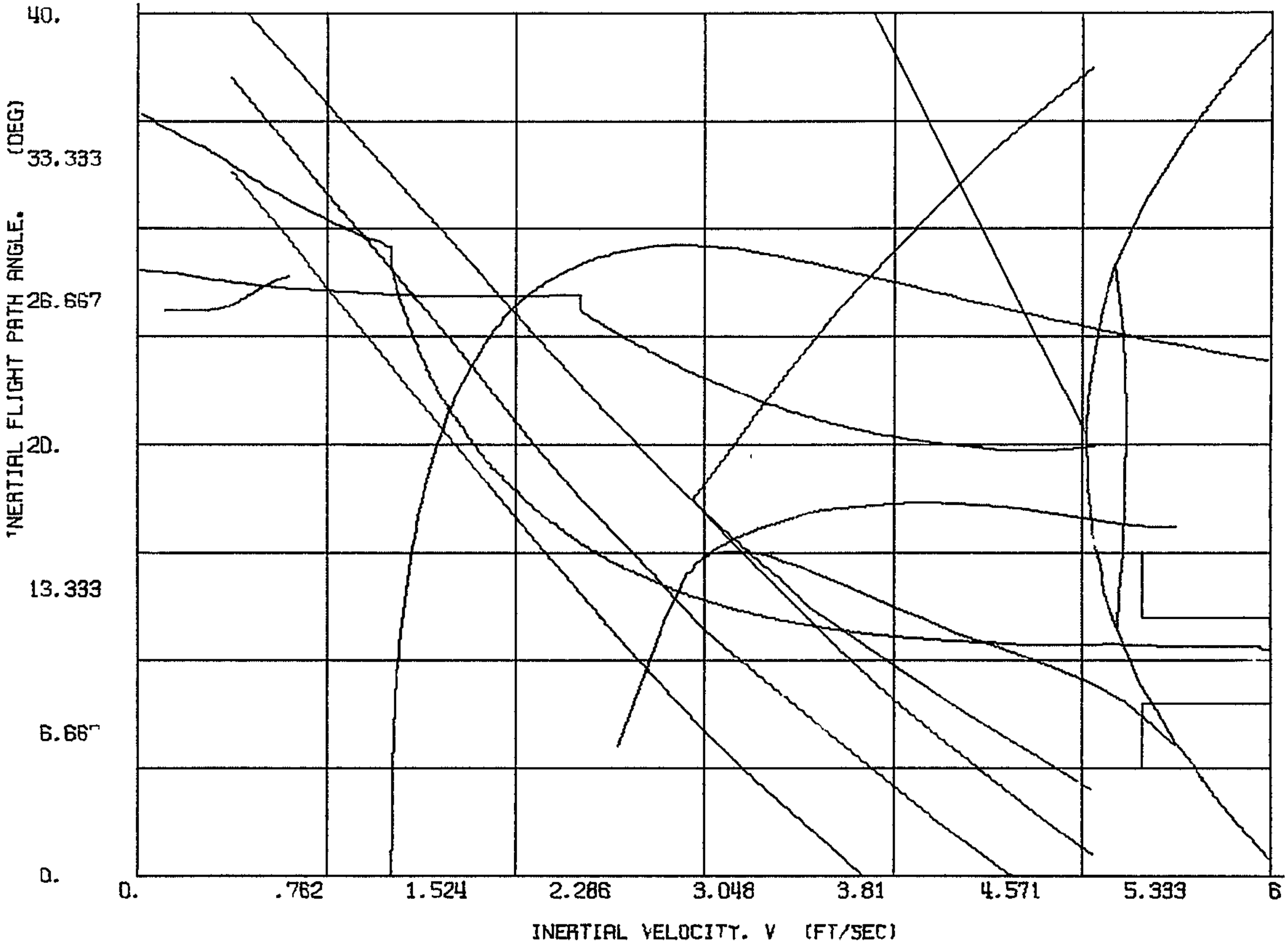


Figure 4-3 Plot Generated by Example 1

```
 ASG F=XXXXX                                    TRWPLT INPUT TAPE
 ASG X=XXXXX                                    TRWPLT PCF TAPE
 ASG P=CCP1                                     CALCOM PLOT TAPE
 ASG G=G                                        CARDS PROCESSOR OUTPUT TAPE
 XQT CUR                                        EXECUTE THE FOLLOWING INSTRUCTIONS
 TRW F,X,P,G                                    REWIND UNIT F,X,P, AND G
 IN X                                           INPUT THE ENTIRE PCF FROM UNIT X
 TRI X                                          REWIND AND INTERLOCK UNIT X
 XQT CARDS                                      EXECUTE THE CARDS PROCESSOR
KUNIT=9                                        *GENERATE DATA ON UNIT G
SYMB=1,TFFHX,TFFHY1,TFFHY2,TFFHY3,             *RECORD TYPE ONE
     TFFHY4,TFFHY5,TFFHY6,TFFHY7,              *CONTAINS THE DATA FOR THE
     TFFHY8,TFFVY,TFFVX1,TFFVX2,TFFVX3*HORIZONTAL AND VERTICLE
    ,TFFVX4,TFFVX5,TFFVX6,ENDLST               *GRID LINES
SYMB=2,X1T100,Y1T100,ENDLST                    *SCALE I/TFF LIMIT=100 SEC
SYMB=3,X3T100,Y3T100,ENDLST                    *SCALE III/TFF LIMIT=100 SEC
SYMB=4,X3T225,Y3T225,ENDLST                    *SCALE III/TFF=225 SEC
SYMB=5,X3ADRA,Y3ADRA,ENDLST                    *SCALE III/R=3350 N MI
SYMB=6,EARLYX,EARLYY,ENDLST                    *EARLY VECTORS-SPECIAL RUN
SYMB=7,LATE-X,LATE-Y,ENDLST                    *LATE VECTORS-SPECIAL RUN
DATA=1,0.,1.,2.,3.,4.,5.,6.,7.,8.,0.,100.,200.,300.,400.,500.,600.
DATA=1,600.,1.,2.,3.,4.,5.,6.,7.,8.,8.,100.,200.,300.,400.,500.,600.
DATA=2,0.,1.67                                 *SCALE I/TFF LIMIT=100 SEC
DATA=2,550.,1.67                               *SCALE I/TFF LIMIT=100 SEC
DATA=3,16.,.562                                *SCALE III/TFF LIMIT=100 SEC
DATA=3,600.,.562                               *SCALE III/TFF LIMIT=100 SEC
DATA=4,16.,1.26                                *SCALE III/TFF=225 SEC
DATA=4,600.,1.26                               *SCALE III/TFF=225 SEC
DATA=5,118.5,8.                                *SCALE III/R=3350 N MI
DATA=5,118.5,0.                                *SCALE III/R=3350 N MI
DATA=6,240.,0.                                 *EARLY VECTORS-SPECIAL RUN
DATA=6,248.,1.7333                             *EARLY VECTORS-SPECIAL RUN
DATA=6,254.,1.55                               *EARLY VECTORS-SPECIAL RUN
DATA=6,261.,2.03                               *EARLY VECTORS-SPECIAL RUN
```

Figure 4-4 Example 2 TRWPLT Input

```
 DATA=6,274.,2.22                                    *EARLY VECTORS-SPECIAL RUN
 DATA=6,288.,2.39                                    *EARLY VECTORS-SPECIAL RUN
 DATA=6,303.,2.54                                    *EARLY VECTORS-SPECIAL RUN
 DATA=6,319.,2.68                                    *EARLY VECTORS-SPECIAL RUN
 DATA=6,330.,2.75                                    *EARLY VECTORS-SPECIAL RUN
 DATA=6,335.,2.81                                    *EARLY VECTORS-SPECIAL RUN
 DATA=6,352.,2.94                                    *EARLY VECTORS-SPECIAL RUN
 DATA=6,362.,3.00                                    *EARLY VECTORS-SPECIAL RUN
 DATA=6,362.,2.97                                    *EARLY VECTORS-SPECIAL RUN
 DATA=6,370.,2.95                                    *EARLY VECTORS-SPECIAL RUN
 DATA=6,381.,2.95                                    *EARLY VECTORS-SPECIAL RUN
 DATA=6,388.,2.95                                    *EARLY VECTORS-SPECIAL RUN
 DATA=6,430.,2.92                                    *EARLY VECTORS-SPECIAL RUN
 DATA=7,383.,5.20                                    *LATE VECTORS-SPECIAL RUN
 DATA=7,416.34,5.62                                  *LATE VECTORS-SPECIAL RUN
 DATA=7,435.65,5.87                                  *LATE VECTORS-SPECIAL RUN
 DATA=7,457.86,6.15                                  *LATE VECTORS-SPECIAL RUN
 DATA=7,483.84,6.48                                  *LATE VECTORS-SPECIAL RUN
 DATA=7,514.91,6.88                                  *LATE VECTORS-SPECIAL RUN
ENDFIL
ENDRUN
  XOT TRWPLT
 TITLE=ID=          FIGURE 5. TIME OF FREE FALL TO 300K VS RANGE TO IMPACT
 XLABEL=ID=                        RANGE TO PREDICTED IMPACT POINT  (N MI)
 YLABEL=ID=                    TIME OF FREE FALL TO ENTRY INTERFACE (MIN)
 KUNIT=9                                             *PLOT DATA FROM UNIT 9
 ICCOMP=1                                            *GENERATE CALCOMP PLOTS
 IPRINT=10                                           *PRINT THE FIRST TEN POINTS TO BE PLOTTE
 PPNM=4.                                             *GRID SELECTION
 ISCALX=1                                            *USE INPUT LIMITS FOR ABSCISSA
 NOFSCL=1                                            *SUPPRESS PLOTTING OFF-SCALE POINTS
 XLO=0.,DELX=75.,XHI=600.                            *ABSCISSA SCALE
 ISCALY=1,1,1,1,1,1,1,1                              *USE INPUT LIMITS FOR ORDINATE
 IFREQ=1,1,1,1,1,1,1,1                               *PLOT EVERY POINT
 CCHAR=0,0,0,0,0,0,0,0                               *GENERATE A LINE PLOT
```

Figure 4-4   Example 2 TRWPLT Input (Continued)

```
 YHI=8.,8.,8.,8.,8.,8.,8.,8.                *ORDINATE SCALE-SETTING UP THE 8 Y
 YLO=0.,0.,0.,0.,0.,0.,0.,0.                *SCALES ENABLES PLOTTING THE HORIZONTAL
 DELY=1.3333333,1.3333333,1.3333333         *GRID LINES IN ONE TRWPLT PHASE
 DELY(4)=1.3333333,1.3333333,1.3333333      *
 DELY(7)=1.3333333,1.3333333                *
 PLOT=TFFHX,1,TFFHY1,1,TFFHY2,1,TFFHY3,1,TFFHY4,1,TFFHY5,1,TFFHY6,1,
      TFFHY7,1,TFFHY8,1,ENDLST              *VARIABLES TO BE PLOTTED
ENDPLT
 NOADV=1                                    *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=TFFVX1,1,TFFVY,1,ENDLST               *VARIABLES TO BE PLOTTED
ENDPLT
 NOADV=1                                    *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=TFFVX2,1,TFFVY,1,ENDLST               *VARIABLES TO BE PLOTTED
ENDPLT
 NOADV=1                                    *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=TFFVX3,1,TFFVY,1,ENDLST               *VARIABLES TO BE PLOTTED
ENDPLT
 NOADV=1                                    *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=TFFVX4,1,TFFVY,1,ENDLST               *VARIABLES TO BE PLOTTED
ENDPLT
 NOADV=1                                    *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=TFFVX5,1,TFFVY,1,ENDLST               *VARIABLES TO BE PLOTTED
ENDPLT
 NOADV=1                                    *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=TFFVX6,1,TFFVY,1,ENDLST               *VARIABLES TO BE PLOTTED
ENDPLT
 NOADV=1                                    *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=X1T100,2,Y1T100,2,ENDLST              *VARIABLES TO BE PLOTTED
ENDPLT
 NOADV=1                                    *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=X3T100,3,Y3T100,3,ENDLST              *VARIABLES TO BE PLOTTED
ENDPLT
 NOADV=1                                    *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=X3T225,4,Y3T225,4,ENDLST              *VARIABLES TO BE PLOTTED
ENDPLT
```

Figure 4-4 Example 2 TRWPLT Input (Continued)

```
 NOADV=1                                   *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=X3ADFA,5,Y3ADFA,5,ENDLST             *VARIABLES TO BE PLOTTED
ENDPLT
 NOADV=1                                   *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=EARLYX,6,EARLYY,6,ENDLST             *VARIABLES TO BE PLOTTED
ENDPLT
 NOADV=1                                   *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=LATE-X,7,LATE-Y,7,ENDLST             *VARIABLES TO BE PLOTTED
 LINGER=1                                  *PLOT THE NEXT FILE ON SAME PLOT
ENDPLT
ENDFIL
 KUNIT=8                                   *PLOT DATA FROM UNIT 8
 NOADV=1                                   *PLOT TRACE ON PREVIOUS GRAPH
 IPRINT=59                                 *PRINT ALL POINTS TO BE PLOTTED
 PLOT=CRNG99,1,TFF20,1,ENDLST              *VARIABLES TO BE PLOTTED
 CMULT=0.,.16666666E-01                    *MULTIPLICATION FACTOR
ENDPLT
 NOADV=1                                   *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=CRNG99,1,TFF20,1,ENDLST              *VARIABLES TO BE PLOTTED
 CMULT=.25                                 *MULTIPLICATION VALUE
ENDPLT
 NOADV=1                                   *PLOT TRACE ON PREVIOUS GRAPH
 PLOT=CRNG99,1,TFF20,1,ENDLST              *VARIABLES TO BE PLOTTED
 CMULT=.83333333E-01,.55555555E-02         *MULTIPLICATION VALUE
 CADD=-.16666666E03                        *ADDITION VALUE
ENDPLT
  ENDFIL
  ENDRUN
```

Figure 4-4. Example 2 TRWPLT Input (Continued)

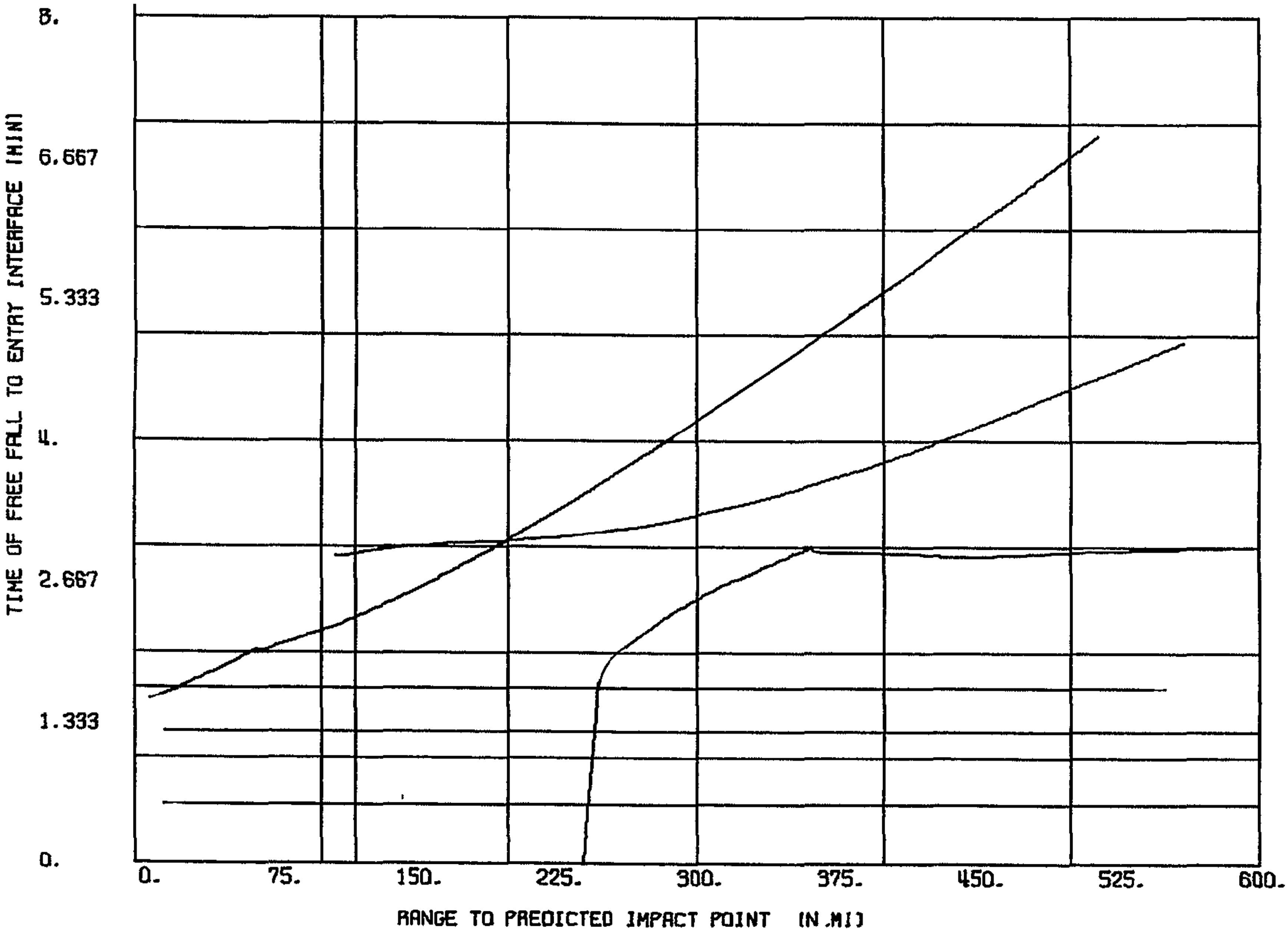


Figure 4-5. Plot Generated by Example 2

APPENDIX A

B-7 TAPE FORMAT

REVISION II (PER MSC) OCTOBER 12, 1966 R-AERO-FMT 876-4255

This will be a binary tape written so that a Fortran Program can use or generate it; i.e., the first word will be dummy.

WORD	SYMBOL	UNIT	DEFINITION
2	TIME	(SEC)	INSTANTANEOUS FLIGHT TIME FROM FIRST MOTION
3	XCG	(M)	PITCH (X) CENTER OF GRAVITY REFERENCED IN BODY SYSTEM
4	YCG	(M)	LONGITUDINAL (Y) CENTER OF GRAVITY REFERENCED FROM GIMBAL STATION IN A BODY SYSTEM
5	ZCG	(M)	NORMAL (Z) CENTER OF GRAVITY IN BODY SYSTEM
6	MOIP	(KG-S^2-M)	PITCH MOMENT OF INERTIA
7	MOIY	(KG-S^2-M)	YAW MOMENT OF INERTIA
8	MOIR	(KG-S^2-M)	ROLL MOMENT OF INERTIA
9	AOP		PITCH AND YAW ATTITUDE ERROR CONTROL GAINS
10	AIP	(SEC)	PITCH AND YAW RATE CONTROL GAIN
11	AOR		ROLL ATTITUDE ERROR CONTROL GAIN
12	AIR	(SEC)	ROLL RATE CONTROL GAIN
13	G2	(RAD/M/S^2)	INERTIAL ACCELERATION CONTROL GAIN
14	PINJ1	(KG/M^2)	CHAMBER PRESSURE AT INJECTION POINT FOR ENGINE 1
15	PINJ2	(KG/M^2)	CHAMBER PRESSURE AT INJECTION POINT FOR ENGINE 2
16	PINJ3	(KG/M^2)	CHAMBER PRESSURE AT INJECTION POINT FOR ENGINE 3
17	PINJ4	(KG/M^2)	CHAMBER PRESSURE AT INJECTION POINT FOR ENGINE 4
18	PINJ5	(KG/M^2)	CHAMBER PRESSURE AT INJECTION POINT FOR ENGINE 5

WORD	SYMBOL	UNIT	DESCRIPTION
19	PINJ6	(KG/M^2)	CHAMBER PRESSURE AT INJECTION POINT FOR ENGINE 6
20	PINJ7	(KG/M^2)	CHAMBER PRESSURE AT INJECTION POINT FOR ENGINE 7
21	PINJ8	(KG/M^2)	CHAMBER PRESSURE AT INJECTION POINT FOR ENGINE 8
22	CFVT1		THRUST COEFFICIENT FOR ENGINE 1
23	CFVT2		THRUST COEFFICIENT FOR ENGINE 2
24	CFVT3		THRUST COEFFICIENT FOR ENGINE 3
25	CFVT4		THRUST COEFFICIENT FOR ENGINE 4
26	CFVT5		THRUST COEFFICIENT FOR ENGINE 5
27	CFVT6		THRUST COEFFICIENT FOR ENGINE 6
28	CFVT7		THRUST COEFFICIENT FOR ENGINE 7
29	CFVT8		THRUST COEFFICIENT FOR ENGINE 8
30	TEX 1	(KG)	TURBINE EXHAUST THRUST FOR ENGINE 1
31	TEX 2	(KG)	TURBINE EXHAUST THRUST FOR ENGINE 2
32	TEX 3	(KG)	TURBINE EXHAUST THRUST FOR ENGINE 3
33	TEX 4	(KG)	TURBINE EXHAUST THRUST FOR ENGINE 4
34	TEX 5	(KG)	TURBINE EXHAUST THRUST FOR ENGINE 5
35	TEX 6	(KG)	TURBINE EXHAUST THRUST FOR ENGINE 6
36	TEX 7	(KG)	TURBINE EXHAUST THRUST FOR ENGINE 7
37	TEX 8	(KG)	TURBINE EXHAUST THRUST FOR ENGINE 8
38	BETAP	(DEG)	GIMBAL DEFLECTION ANGLE REQUIRED IN PITCH CHANNEL
39	BETAY	(DEG)	GIMBAL DEFLECTION ANGLE REQUIRED IN YAW CHANNEL
40	BETAR	(DEG)	GIMBAL DEFLECTION ANGLE REQUIRED IN ROLL CHANNEL
41	PHIP	(DEG)	EULERIAN ANGLE OF ATTITUDE IN PITCH
42	PHIY	(DEG)	EULERIAN ANGLE OF ATTITUDE IN YAW
43	PHIR	(DEG)	EULERIAN ANGLE OF ATTITUDE IN ROLL
44	CP	(M)	CENTER OF PRESSURE MEASURED FROM GIMBAL STATION IN BODY-FIXED SYSTEM

WORD	SYMBOL	UNIT	DEFINITION
45	CZALM	(1/RAD)	COEFFICIENT OF NORMAL FORCE PER RADIAN OF ALPP
46	CX		COEFFICIENT OF AXIAL FORCE
47	DRAG	(KG)	RETARDING FORCE ALONG THE VELOCITY VECTOR
48	ALPPP	(DEG)	PITCH PLANE ANGLE OF ATTACK MEASURE FROM THE BODY-FIXED Y AXIS TO THE PROJECTION OF THE RELATIVE VELOCITY IN THE $X_M Y_M$ PLANE
49	ALPYP	(DEG)	YAW PLANE ANGLE OF ATTACK MEASURED FROM THE BODY-FIXED Y AXIS TO THE PROJECTION OF THE RELATIVE VELOCITY IN THE $Y_M Z_M$ PLANE
50	ALPP	(DEG)	TOTAL ANGLE OF ATTACK
51	ALPY	(DEG)	ORIENTATION ANGLE FOR ALPP
52	ALPQ	(KG/M^2)	AERODYNAMIC LOAD Q·ALPP
53	VS	(M/S)	SPEED OF SOUND
54	RHO	$\frac{(KG-S^2)}{M^4}$	ATMOSPHERIC DENSITY
55	PAMB	(KG/M^2)	AMBIENT PRESSURE AT THE C.G.
56	NORF	(KG)	MAGNITUDE OF THE AERODYNAMIC FORCE VECTOR PERPENDICULAR TO THE VEHICLE LONGITUDINAL AXIS
57	H.I.	(KG-M)	AERODYNAMIC HEATING INDICATOR - $\int_{TO}^{T} \frac{RHO \cdot VR^3}{90 - ALPP\ (DEG)} \cdot \frac{57.2958}{2}$
58	FAMX	(KG)	X-COMPONENT OF AERODYNAMIC FORCE IN BODY-FIXED SYSTEM
59	FAMY	(KG)	Y-COMPONENT OF AERODYNAMIC FORCE IN BODY-FIXED SYSTEM
60	FAMZ	(KG)	Z-COMPONENT OF AERODYNAMIC FORCE IN BODY-FIXED SYSTEM
61	WIND	(M/S)	ABSOLUTE MAGNITUDE OF WIND VELOCITY
62	W_X	(M/S)	X-COMPONENT OF SPACE-FIXED WIND VELOCITY

WORD	SYMBOL	UNIT	DEFINITION
63	W_Y	(M/S)	Y-COMPONENT OF SPACE-FIXED WIND VECTOR
64	W_Z	(M/S)	Z-COMPONENT OF SPACE-FIXED WIND VECTOR
65	WAZI	(DEG)	AZIMUTH OF WIND, DIRECTION BEING THAT FROM WHICH THE WIND IS BLOWING
66	BLANK		DUMMY WORD REQUIRED BY CAPE (AMTR)
67	TIME	(SEC)	INSTANTANEOUS FLIGHT TIME FROM FIRST MOTION
68	XXXE	(M)	POSITION COORDINATES IN AN EARTH-FIXED, LAUNCH POINT CENTERED, PLUMBLINE SYSTEM. SYSTEM IS INITIALLY PARALLEL TO XPP SYSTEM (DESCRIBED BELOW).
69	ZZZE	(M)	
70	YYYE	(M)	
71	DXXE	(M/S)	X-COMPONENT OF VELOCITY IN THE XXXE SYSTEM
72	DZZE	(M/S)	Z-COMPONENT OF VELOCITY IN THE XXXE SYSTEM
73	DYYE	(M/S)	Y-COMPONENT OF VELOCITY IN THE XXXE SYSTEM
74	DDRX	(M/S^2)	X-COMPONENT OF ACCELERATION IN THE XXXE SYSTEM
75	DDRZ	(M/S^2)	Z-COMPONENT OF ACCELERATION IN THE XXXE SYSTEM
76	DDRY	(M/S^2)	Y-COMPONENT OF ACCELERATION IN THE XXXE SYSTEM
77	L11		DIRECTION COSINES OF ROLL AXIS
78	L21		
79	L31		
80	L12		DIRECTION COSINES OF PITCH AXIS
81	L22		
82	L32		
83	L13		DIRECTION COSINES OF YAW AXIS
84	L23		
85	L33		

Definition: The referenced system for the direction cosines is the EFG coordinate system which is a right-handed, earth-centered, earth-fixed coordinate system whose positive G-axis is the north polar axis. The E and F axes are in the equatorial plane and the positive E axis cuts the prime meridian. The positive F axis cuts the 90° east meridian.

$$\begin{bmatrix} E \\ F \\ G \end{bmatrix} = \begin{bmatrix} L11 & L12 & L13 \\ L21 & L22 & L23 \\ L31 & L32 & L33 \end{bmatrix} \begin{bmatrix} X_N \\ Y_N \\ Z_N \end{bmatrix}$$

where X_N, Y_N, Z_N are the unit vectors along the roll, pitch, and yaw axes respectively.

WORD	SYMBOL	UNIT	DEFINITION
86	(LATT)	(DEG)	GEODETIC LATITUDE (SUB-VEHICLE LATITUDE ON SPHERICAL EARTH)
87	(LONG)	(DEG)	SUB-VEHICLE LONGITUDE ON SPHERICAL EARTH

Definition: The sub-missile point is that point on the referenced spheroid which is located by the normal to the spheriod which passes through the tracking point on the vehicle.

88	(ALT)	(M)	ALTITUDE ABOVE SPHERICAL EARTH
89	VRS	(M/SEC)	MAGNITUDE OF RELATIVE VELOCITY VECTOR
90	(AR)	(M/S^2)	TOTAL EARTH-FIXED ACCELERATION
911	(RA)	(KM)	ARC RANGE ALONG SPHERICAL EARTH SURFACE TO SUB-VEHICLE POINT
92	(PAV)	(DEG)	PATH ANGLE OF VELOCITY VECTOR MEASURED FROM LOCAL HORIZONTAL
93	(TIIP)	(SEC)	TIME OF FLIGHT REMAINING TO INSTANTANEOUS VACUUM IMPACT
94	LATTIP	(DEG)	GEODETIC LATITUDE OF INSTANTANEOUS VACUUM IMPACT POINT
95	LONGIP	(DEG)	LONGITUDE OF INSTANTANEOUS VACUUM IMPACT POINT

WORD	SYMBOL	UNIT	DEFINITION
96	(RIIP)	(KM)	ARC GROUND RANGE FROM LAUNCHING PAD TO INSTANTANEOUS VACUUM IMPACT POINT
97	FORCE	(NEWTONS)	TOTAL VEHICLE ENGINE THRUST
98	TOLWT	(KG)	TOTAL VEHICLE WEIGHT
99	E	(M)	E-POSITION COORDINATE
100	F	(M)	F-POSITION COORDINATE
101	G	(M)	G-POSITION COORDINATE
102	VE	(M/SEC)	E-VELOCITY COMPONENT IN THE EFG SYSTEM
103	VF	(M/SEC)	F-VELOCITY COMPONENT IN THE EFG SYSTEM
104	VG	(M/SEC)	G-VELOCITY COMPONENT IN THE EFG SYSTEM

Definition: The EFG coordinate system is a right-handed, earth-centered, earth-fixed system whose positive G axis is the north polar axis. The E and F axes are in the equatorial plane and the positive E axis cuts the prime meridian.

105 106 107	XIO ETAO ZETAO	(M) (M) (M)	SPACE-FIXED SYSTEM WITH ORIGIN AT THE LAUNCH POINT WITH THE XIO AXIS IN THE FIRING DIRECTION AT AN ANGLE $\varepsilon p0$ TO THE HORIZON. ETA AXIS IS IN THE PLANE OF FIRING. (SECOND INTEGRAL OF THE MEASURED ACCELERATION MEASURED IN THE SPACE-FIXED PAD CENTERED PLUMBLINE SYSTEM. THIS IS AN IDEAL PLATFORM SYSTEM.)
108	DXIO	(M/SEC)	X-VELOCITY COMPONENT IN THE XIO SYSTEM
109	DETAO	(M/SEC)	Y-VELOCITY COMPONENT IN THE XIO SYSTEM
110	DZETAO	(M/SEC)	Z-VELOCITY COMPONENT IN THE XIO SYSTEM
111	DDXIO	(M/S^2)	X-ACCELERATION COMPONENT IN THE XIO SYSTEM
112	DDETAO	(M/S^2)	Y-ACCELERATION COMPONENT IN THE XIO SYSTEM
113	DDZETO	(M/S^2)	Z-ACCELERATION COMPONENT IN THE XIO SYSTEM

WORD	SYMBOL	UNIT	DEFINITION
114	VVVE	(M/SEC)	MAGNITUDE OF THE EARTH-FIXED VELOCITY
115	RP(NM)	(N.MILES)	ARC GROUND RANGE FROM LAUNCING PAD TO THE INSTANTANEOUS VACUUM IMPACT POINT
116	(AL)	(M/S^2)	VEHICLE LONGITUDINAL ACCELERATION (Y_M)
117	RNG/NM	(N.MILES)	GROUND RANGE TO SUB-VEHICLE POINT
118	MACH	(M)	MACH NUMBER
119	QQQ	(NEW/M^2)	DYNAMIC PRESSURE
120	CHPCMD	(DEG)	COMMANDED PITCH ATTITUDE (X_P) (LIMITED)
121	CHYCMD	(DEG)	COMMANDED YAW ATTITUDE (X_Y) (LIMITED)
122	CHIR	(DEG)	COMMANDED ROLL ATTITUDE (X_I) (LIMITED)
123	XPCRR	(DEG)	DESIRED PITCH ATTITUDE (NOT LIMITED)
124	XYCRR	(DEG)	DESIRED YAW ATTITUDE (NOT LIMITED)
125	DTCHP	(DEG/S)	CHI PITCH RATE (COMMANDED)
126	DTCHY	(DEG/S)	CHI YAW RATE (COMMANDED)
127	DCHIR	(DEG/S)	CHI ROLL RATE (COMMANDED)
128	DPHIP	(DEG/S)	EULERIAN ATTITUDE RATE IN PITCH
129	DPHIY	(DEG/S)	EULERIAN ATTITUDE RATE IN YAW
130	DPHIR	(DEG/S)	EULERIAN ATTITUDE RATE IN ROLL
131	OMEGAX	(DEG/S)	BODY-FIXED ANGULAR RATE ABOUT X
132	OMEGAY	(DEG/S)	BODY-FIXED ANGULAR RATE ABOUT Y
133	OMEGAZ	(DEG/S)	BODY-FIXED ANGULAR RATE ABOUT Z
134 135 136	XPP YPP ZPP	(M) (M) (M)	POSITION COORDINATE IN A SPACE-FIXED, EARTH-CENTERED, PLUMBLINE SYSTEM

Definition: The YPP axis goes through the launch meridian and is parallel to the gravity gradient. The XPP axis is parallel to the earth-fixed flight azimuth. The ZPP axis is perpendicular to the X plane of the XPP and YPP axes forming a right hand system.

WORD	SYMBOL	UNIT	DEFINITION
137	DXPP	(M/SEC)	X-VELOCITY COMPONENT IN XPP SYSTEM ABOVE
138	DYPP	(M/SEC)	Y-VELOCITY COMPONENT IN XPP SYSTEM ABOVE
139	DZPP	(M/SEC)	Z-VELOCITY COMPONENT IN XPP SYSTEM ABOVE
140	DDXP	(M/S^2)	X-ACCELERATION COMPONENT IN XPP SYSTEM ABOVE
141	DDYP	(M/S^2)	Y-ACCELERATION COMPONENT IN XPP SYSTEM ABOVE
142	DDZP	(M/S^2)	Z-ACCELERATION COMPONENT IN XPP SYSTEM ABOVE
143	DUMMY WORD		ZERO
144 145 146	XM YM ZM	(M) (M) (M)	VEHICLE (BODY) FIXED COORDINATE SYSTEM, WITH THE ORIGIN AT C.G. OF THE VEHICLE. THIS SYSTEM IS PARALLEL TO XPP COORDINATE SYSTEM AT GRR (GUIDANCE REFERENCE RELEASE)
147	DXM	(M/SEC)	X-VELOCITY COMPONENT IN THE $\bar{X}_M$ SYSTEM
148	DYM	(M/SEC)	Y-VELOCITY COMPONENT IN THE $\bar{X}_M$ SYSTEM
149	DZM	(M/SEC)	Z-VELOCITY COMPONENT IN THE $\bar{X}_M$ SYSTEM
150	DDXM	(M/S^2)	X-ACCELERATION COMPONENT IN THE X_M SYSTEM
151	DDYM	(M/S^2)	Y-ACCELERATION COMPONENT IN THE X_M SYSTEM
152	DDZM	(M/S^2)	Z-ACCELERATION COMPONENT IN THE Z_M SYSTEM
153	AZ	(DEG)	SPACE-FIXED LAUNCH AZIMUTH MEASURED FROM NORTH
154	AZI	(DEG)	EARTH-FIXED LAUNCH AZIMUTH MEASURED FROM NORTH
155	VV	(M/SEC)	MAGNITUDE OF SPACE-FIXED VELOCITY ($\overline{XPP}$ SYSTEM)
156	VR	(M/SEC)	MAGNITUDE OF VELOCITY RELATIVE TO THE AMBIENT ATMOSPHERE INCLUDING WIND

WORD	SYMBOL	UNIT	DEFINITION
157	VTH	(DEG)	SPACE-FIXED PATH ANGLE. RADIAL POSITION VECTOR TO VV MEASURED IN Xp. AT TIME ZERO, VTH WILL BE 90 DEG SINCE ALL OF THE VELOCITY IS FROM THE EARTH'S ROTATION.
158	VTHE	(DEG)	EARTH-FIXED PATH ANGLE. RADIAL POSITION VECTOR TO VVVE MEASURED IN XXXE SYSTEM. (COMPLEMENT OF PAV).
159	THEP	(DEG)	EARTH-FIXED PATH ANGLE MEASURED FROM LAUNCH POINT YYYE TO VVVE MEASURED IN XXXE SYSTEM
160	THEY	(DEG)	EARTH-FIXED PATH ANGLE MEASURED FROM THE XEYE PITCH PLANE TO VVVE CLOCKWISE MEASURED IN XXXE
161	RRR	(M)	RADIAL DISTANCE OF THE C.G. FROM THE CENTER OF THE EARTH IN THE XPP SYSTEM
162	ALT	(M)	ALTITUDE ABOVE OBLATE EARTH
163	PHID	(DEG)	GEODETIC LATITUDE
164		(DEG)	DECLINATION
165	LAMB	(DEG)	LONGITUDE ON OBLATE EARTH
166	THRUST	(LB_F)	TOTAL ENGINE THRUST
167	FIX	(KG)	X-COMPONENT IN BODY SYSTEM OF TOTAL ENGINE THRUST
168	FTY	(KG)	Y-COMPONENT IN BODY SYSTEM OF TOTAL ENGINE THRUST
169	FTZ	(KG)	Z-COMPONENT IN BODY SYSTEM OF TOTAL ENGINE THRUST
170	FO1	(KG)	THRUST FROM ENGINE NO. 1
171	FO2	(KG)	THRUST FROM ENGINE NO. 2
172	FO3	(KG)	THRUST FROM ENGINE NO. 3
173	FO4	(KG)	THRUST FROM ENGINE NO. 4
174	FO5	(KG)	THRUST FROM ENGINE NO. 5
175	F/M	(M/S^2)	ACCELERATION (THRUST - MASS)
176	SVEL	(M/S)	SLANT VELOCITY
177	DVVE	(M/S^2)	RADIAL ACCELERATION COMPONENT OF (AR)
178	RNG/SL	(M)	SLANT RANGE
179	PHIC	(DEG)	CENTRAL RANGE ANGLE

***The following parameters are related to LVDC (Launch Vehicle Digital Computer) i.e., IGM and navigation.

WORD	SYMBOL	UNIT	DEFINITION
180	K1	(RAD)	ALTITUDE CONSTRAINT ON IGM PITCH COMMAND
181	K2	(RAD/SEC)	VELOCITY CONSTRAINT ON IGM PITCH COMMAND
182	K3	(RAD)	ALTITUDE CONSTRAINT ON IGM YAW COMMAND
183	K4	(RAD/SEC)	VELOCITY CONSTRAINT ON IGM YAW COMMAND
184	CHITP	(DEG)	THRUST ATTITUDE ANGLE IN THE PITCH PLANE NECESSARY TO ALIGN THE THRUST ALONG THE DELTA V VECTOR
185 186	CHITY DVXI	(DEG) (M/SEC)	THRUST ATTITUDE ANGLE IN THE YAW PLANE NECESSARY TO ALIGN THE THRUST ALONG THE DELTA V VECTOR
187 188	DVETA DVZETA	(M/SEC) (M/SEC)	IGM VELOCITY TO GO BEFORE CUT-OFF, MEASURED IN SPACE-FIXED SYSTEM
189	PHIT	(DEG)	EARTH CENTER RANGE ANGLE TO IGM PREDICTED CUTOFF POINT
190	TAU1	(SEC)	IGM FIRST STAGE TIME TO GO TO END OF FLIGHT BASED ON MASS DEPLETION USING FIRST STAGE ISP
191	TAU2	(SEC)	IGM SECOND STAGE TIME TO GO TO END OF FLIGHT BASED ON MASS DEPLETION USING SECOND STAGE ISP
192 193 194	XPN YPN ZPN	(M) (M) (M)	NAVIGATION MODEL POSITION COMPONENTS IN SPACE-FIXED SYSTEM. THIS SYSTEM IS PARALLEL TO THE $\overline{XPP}$ SYSTEM.
195	DXPN	(M/SEC)	X-VELOCITY COMPONENT IN THE $\overline{XPN}$ SYSTEM
196	DYPN	(M/SEC)	Y-VELOCITY COMPONENT IN THE $\overline{XPN}$ SYSTEM
197	DZPN	(M/SEC)	Z-VELOCITY COMPONENT IN THE $\overline{XPN}$ SYSTEM
198 199 200	XIMN ZETAMN ZETAMN	(M) (M) (M)	DISPLACEMENT COMPONENT IN THE ONBOARD INERTIAL SYSTEM AS SEEN FROM NAVIGATION MODEL. PARALLEL TO XIO SYSTEM.

WORD	SYMBOL	UNIT	DEFINITION
201	DXIMN	(M/SEC)	X-VELOCITY COMPONENT IN THE XIMN SYSTEM
202	DETAMN	(M/SEC)	Y-VELOCITY COMPONENT IN THE XIMN SYSTEM
203	DZTAMN	(M/SEC)	Z-VELOCITY COMPONENT IN THE XIMN SYSTEM
204	RRRN	(M)	RADIUS COMPUTED IN THE XPN SYSTEM
205	VTHN	(DEG)	SPACE-FIXED PATH ANGLE COMPUTED IN XPN SYSTEM

***The following parameters are conic parameters.

WORD	SYMBOL	UNIT	DEFINITION
206	A	(M)	SEMI-MAJOR AXIS
207	E	(U)	ORBIT ECCENTRICITY
208	RA	(M)	APOGEE RADIUS
209	RP	(M)	PERIGEE RADIUS
210	SCR	(M)	SEMI-LATUS RECTUM
211	TPERIG	(SEC)	TIME OF PERIGEE
212	PERIOD	(SEC)	PERIOD OF THE ORBIT
213	ANGMON	(KGW-SEC-M)	SPECIFIC ANGULAR MOMENTUM
214	ENERGY	(KGW-M)	SPECIFIC ENERGY
215	VP	(M/SEC)	VELOCITY AT PERIGEE
216	VA	(M/SEC)	VELOCITY AT APOGEE
217	INC	(DEG)	INCLINATION
218	THN	(DEG)	LONGITUDE OF DESCENDING NODE
219	ECC.AN	(DEG)	ECCENTRIC ANOMALY
220	TRUE A	(DEG)	TRUE ANOMALY
221	ARGPER	(DEG)	ARGUMENT OF PERIGEE
222	DDXIMN	(M/SEC^2)	X-ACCELERATION COMPONENT IN THE XIMN SYSTEM
223	DDETMN	(M/SEC^2)	Y-ACCELERATION COMPONENT IN THE XIMN SYSTEM
224	DDZEMN	(M/SEC^2)	Z-ACCELERATION COMPONENT IN THE XIMN SYSTEM

WORD	SYMBOL	UNIT	DEFINITION
225	DDXPG	(M/SEC^2)	GRAVITATIONAL ACCELERATION COMPONENTS
226	DDYPG	(M/SEC^2)	IN THE XXP SYSTEM, SPACE-FIXED PLUMB-
227	DDZPG	(M/SEC^2)	LINE COORDINATE SYSTEM
228	X4	(M)	POSITION COMPONENTS IN THE ORBITAL
229	Y4	(M)	REFERENCE SYSTEM
230	Z4	(M)	
231	XIG	(M)	POSITION COMPONENTS IN THE TERMINAL
232	ETAG	(M)	REFERENCE SYSTEM
233	ZETAG	(M)	
234	DDXPGN	(M/SEC^2)	GRAVITATIONAL ACCELERATION COMPONENTS
235	DDYPGN	(M/SEC^2)	AS COMPUTED BY THE ONBOARD GRAVITY
236	DDZPGN	(M/SEC^2)	MODEL
237	MOFS	(M/SEC^2)	SMOOTHED VALUE OF M/F
238	T1I	(SEC)	TIME REMAINING IN THE FIRST STAGE OF IGM
239	T2I	(SEC)	TIME REMAINING IN THE SECOND OR FOURTH STAGES OF IGM
240	T3I	(SEC)	ESTIMATED THIRD OR FIFTH STAGE BURN TIME
241	DDPHP	(DEG/SEC^2)	PITCH, YAW, AND ROLL, ORDERED
242	DDPHY	(DEG/SEC^2)	ROTATIONAL ACCELERATIONS OF THE
243	DDPHR	(DEG/SEC^2)	VEHICLE AXIS

244 - 256 WILL BE LEFT BLANK FOR ADDITIONAL WORDS.

APPENDIX B

FORMAT OF POSTPROCESSOR F TAPE

2 TIME	3 ALT	4 VI	5 RI	6 MASS
7 WEIGHT	8 THRUST	9 RIE	10 MACH	11 VR
12 VS	13 WDØT	14 ISP	15 AHI	16 E
17 VW	18 PA	19 TEMP	20 RHØ	21 Ø
22 CG	23 CP	24 RØ	25 REØ	26 RNG
27 RNGE	28 AI	29 AX	30 AY	31 AZ
32 AXP	33 AYP	34 AZP	35 TX	36 TY
37 TZ	38 TXP	39 TYP	40 TZP	41 GXP
42 GYP	43 GZP	44 XI	45 YI	46 ZI
47 XDI	48 YDI	49 ZDI	50 XDDI	51 YDDI
52 ZDDI	53 XDIW	54 YDIW	55 ZDIW	56 XDPR
57 YDPR	58 ZDPR	59 XDPW	60 YDPW	61 ZDPW
62 XE	63 YE	64 ZE	65 XDE	66 YDE
67 ZDE	68 XDDE	69 YDDE	70 ZDDE	71 VE
62 L1P	73 L2P	74 L3P	75 QALPHA	76 TVAC
66 MU	78 HSV	79 LAMDAL	80 LAMDAI	81 LAMDA
82 PHIL	83 PHIPR	84 PHI	85 GAMI	86 GAMR
87 AZL	88 AZI	89 AZR	90 AZW	91 CHIP
92 CHIY	93 CHIPD	94 CHIYD	95 ALPHAP	96 ALPHAY
97 ALPHPD	98 ALPHYD	99 INC	100 DELP	101 DELY
102 THN	103 PHT	104 PHII	105 XRARP	106 XBARY
107 PRNG	108 PRNGE	109 ALPHT	110 PHISV	111 PHIPSV
112 XDDP	113 YDDP	114 ZDDP	115 TLDD1	116 TLDD2
117 TLDD3	118 XDDM	119 YDDM	120 ZDDM	121 TLD7
122 XDP	123 YDP	124 ZDP	125 TLD1	126 TLD2
127 YLD3	128 XDM	129 YDM	130 ZDM	131 TL7
132 XP	133 YP	134 ZP	135 TL1	136 TL2
137 TL3	138 XM	139 YM	140 ZM	141 K1
142 K2	143 K3	144 K4	145 T1	146 T2
147 T3	148 TAU1	149 TAU2	150 TAU3	151 XXI
152 ETA	153 ZETA	154 DXXI	155 DETA	156 DZETA
157 ISCK	158 PHIT	159 RLAMT	160 PHIPT	161 TFLHT
162 TSTAE	163 AXE	169 AXH	170 TAUE	171 VP
172 VAE	173 TNØM	174 TPØE	175 TPØP	176 TPØH
177 HPE	178 HAE	179 TAØE	180 ANØMN	181 ARAD
182 APER	183 ASCL	184 X11	185 Y11	186 Z11
187 XD11	188 YD11	189 ZD11	190 XDD11	191 YDD11
192 ZDD11	193 X13	194 Y13	195 Z13	196 XD13
197 YD13	198 ZD13	199 XDD13	200 YDD13	201 ZDD13
202 ZX13	203 AY13	204 AZ13	205 TX13	206 TY13
207 TZ13	208 GX13	209 GY13	210 GZ13	211 L113
212 L213	213 L313	214 TGUIDE	215 X10	216 Y10
217 Z10	218 VSTAR	219 VLGI	220 VLGR	221 VLTVI
222 VLTVR	223 VLAI	224 VLAR	225 VLAT	226 IDLIMP
227 ACTTMP	228 RT	229 VT	230 GRAVT	231 ECCP
232 SRECP	233 RAPØG	234	235 TANØM	236 GAMT
237	238	239	240	241
242	243	244	245	246
247	248	249	250	251

The mnemonics and their locations on the F tape record will be defined in alphabetical order in the pages to follow. These mnemonics are also specified by the module/option in which they are calculated. The following abreviations will be used:

LOC	Mnemonic location within the record		
SYMBOL	Output mnemonic		
MODULE	Program module/option where mnemonic is calculated		
	<u>TRAJ</u>	<u>Trajectory Module</u>	
		COV	COV option
		IGM	IGM option
		COV/IGM	Either option of COV or IGM
		HDWRE	Hardware Errors option
		VLOSS	Velocity Losses option
	<u>POST</u>	<u>Postprocessor Module</u>	
		CONIC	Osculating conic option
		IMPACT	Instantaneous impact point option
DESCRIPTION	Description and/or definition of output mnemonic		
UNITS	Output mnemonic units on the F tape <u>NOTE</u>: 1) The unit KG denotes force, not mass. 2) A number contained in the unit denotes a power (e.g., M2=M^2).		

DEFINITIONS OF POSTPROCESSOR OUTPUT MNEMONICS

LOC	SYMBOL	MODULE	DESCRIPTION	UNITS
227	ACTIMP	VLOSS	ACCUMULATED ACTUAL IMPULSE REFERENCED TO INITIAL TIME	KG-S
028	AI	TRAJ	INERTIAL ACELERATION	M/S2
015	AHI	TRAJ	AERODYNAMIC HEATING INDICATOR	KG-M/M2
095	ALPHAP	TRAJ	PITCH COMPONENT OF TOTAL ANGLE OF ATTACK (+ UP FROM RELATIVE OR INERTIAL VELOCITY VECTOR TO PROJECTION OF VEHICLE XM AXIS INTO PLANE FORMED BY RESPECTIVE VELOCITY VECTOR AND YP AXIS)	DEG
096	ALPHAY	TRAJ	YAW COMPONENT OF TOTAL ANGLE OF ATTACK (+ RIGHT FROM PLANE FORMED BY RESPECTIVE VELOCITY VECTOR AND UP AXIS TO VEHICLE XM AXIS)	DEG
097	ALPHPD	1-COV	TIME RATE OF CHANGE OF THE PITCH COMPONENT OF TOTAL ANGLE OF ATTACK (+ UP RATE)	DEG/S
		2-HDWRE	HARDWARE ERROR INERTIAL FLIGHT PATH ANGLE (+ UP FROM LOCAL HORIZONTAL)	DEG
109	ALPHT	TRAJ	TOTAL ANGLE OF ATTACK MEASURED BETWEEN MISSILE AXIS AND RELATIVE VELOCITY VECTOR IN ATMOSPHERE AND INERTIAL VELOCITY VECTOR IN VACUUM	DEG
098	ALPHYD	1-COV	TIME RATE OF CHANGE OF THE YAW COMPONENT OF TOTAL ANGLE OF ATTACK (+ RIGHT RATE)	DEG/S
		2-HDWRE	HARDWARE ERROR ORBIT INCLINATION ANGLE	DEG
003	ALT	TRAJ	ALTITUDE ALONG LOCAL EARTH RADIUS	M
163	AMØM	CONIC	ANGULAR MOMENTUM	M2/S
180	ANØMM	CONIC	MEAN ANOMALY (+ IN DIRECTION OF MOTION)	DEG
182	APER	CONIC	ANGLE FROM ASCENDING NODE TO PERIGEE VECTOR (+ IN DIRECTION OF MOTION)	DEG
181	ARAD	CONIC	ANGLE FROM ASCENDING NODE TO RADIUS VECTOR (+ IN DIRECTION OF MOTION)	DEG
183	ASCL	CONIC	LONGITUDE OF FIRST ASCENDING NODE REFERENCED TO EARTH-FIXED GREENWICH (+ EAST)	DEG

DEFINITIONS OF POSTPROCESSOR OUTPUT MNEMONICS (CONTINUED)

LOC SYMBOL	MODULE	DESCRIPTION	UNITS
029 AX	TRAJ	X-COMPONENT OF AERODYNAMIC FORCE, MISSILE SYSTEM (AXIAL FORCE)	KG
202 AX13	POST	X-COMPONENT OF AERODYNAMIC FORCE, APOLLO 13 SYSTEM	KG
168 AXE	CONIC	SEMI-MAJOR AXIS OF ELLIPTIC ORBIT	M
169 AXH	CONIC	SEMI-MAJOR AXIS OF HYPERBOLIC ORBIT	M
032 AXP	TRAJ	X-COMPONENT OF AERODYNAMIC FORCE, INERTIAL PLUMBLINE SYSTEM	KG
030 AY	TPAJ	Y-COMPONENT OF AERODYNAMIC FORCE, MISSILE SYSTEM (SIDE FORCE)	KG
203 AY13	POST	Y-COMPONENT OF AERODYNAMIC FORCE, APOLLO 13 SYSTEM	KG
033 AYP	TRAJ	Y-COMPONENT OF AERODYNAMIC FORCE, INERTIAL PLUMBLINE SYSTEM	KG
031 AZ	TRAJ	Z-COMPONENT OF AERODYNAMIC FORCE, MISSILE SYSTEM (NORMAL FORCE)	KG
204 AZ13	POST	Z-COMPONENT OF AERODYNAMIC FORCE, 13 SYSTEM	KG
088 AZI	TRAJ	INERTIAL VELOCITY VECTOR AZIMUTH (+ EAST OF NORTH)	DEG
087 AZL	TRAJ	LAUNCH AZIMUTH (+ EAST OF NORTH)	DEG
034 AZP	TRAJ	Z-COMPONENT OF AERODYNAMIC FORCE, INERTIAL PLUMBLINE SYSTEM	KG
089 AZR	TRAJ	RELATIVE VELOCITY VECTOR AZIMUTH (+ EAST OF NORTH)	DEG
090 AZW	TRAJ	WIND AZIMUTH (+ EAST OF NORTH)	DEG
022 CG	TRAJ	CENTER OF GRAVITY MEASURED FROM THE REFERENCE DATUM	M
091 CHIP	TRAJ	PITCH ATTITUDE ANGLE OF THE VEHICLE, INERTIAL PLUMBLINE SYSTEM (+ UP FROM INERTIAL HORIZONTAL XP-ZP PLANE TO PROJECTION OF VEHICLE XM AXIS INTO INERTIAL VERTICAL XP-YP PLANE)	DEG
093 CHIRD	COV/IGM	TIME RATE OF CHANGE OF THE PITCH ATTITUDE ANGLE, INERTIAL PLUMBLINE SYSTEM (+ UP RATE)	DEG/S
092 CHIY	TRAJ	YAW ATTITUDE ANGLE OF THE VEHICLE, INERTIAL PLUMBLINE SYSTEM (+ LEFT FROM INERTIAL VERTICAL XP-YP PLANE TO VEHICLE XM AXIS)	DEG

DEFINITIONS OF POSTPROCESSOR OUTPUT MNEMONICS (CONTINUED)

LOC SYMBOL	MODULE	DESCRIPTION	UNITS
094 CHIYD	COV/IGM	TIME RATE OF CHANGE OF THE YAW ATTITUDE ANGLE, INERTIAL PLUMBLINE SYSTEM (+ LEFT RATE)	DEG/S
023 CP	TRAJ	CENTER OF PRESSURE MEASURED FROM THE REFERENCE DATUM	M
100 DELP	TRAJ	PITCH DEFLECTION ANGLE OF SWIVELABLE THRUST VECTOR (+ DOWN FROM VEHICLE YAW XM-YM PLANE TO PROJECTION OF SWIVELABLE THRUST VECTOR INTO VEHICLE PITCH XM-ZM PLANE)	DEG
101 DELY	TRAJ	YAW DEFLECTION ANGLE OF SWIVELABLE THRUST VECTOR (+ LEFT FROM VEHICLE PITCH XM-ZM PLANE TO SWIVELABLE THRUST VECTOR)	DEG
155 DETA	IGM	Y-COMPONENT OF INERTIAL VELOCITY VECTOR, IGM COORDINATE SYSTEM	M/S
154 DXXT	IGM	X-COMPONENT OF INERTIAL VELOCITY VECTOR, IGM COORDINATE SYSTEM	M/S
156 DZETA IG	IGM	Z-COMPONENT OF INERTIAL VELOCITY VECTOR, IGM COORDINATE SYSTEM	M/S
016 E	TRAJ	ENERGY PER UNIT MASS	M2/S2
164 ECC	CONIC	ORBIT ECCENTRICITY	-
231 ECCP	IGM	ECCENTRICITY OF DESIRED ORBIT -- AVAILABLE ONLY WITH IGM OPTION IORBIT=3	-
152 ETA	IGM	Y-COMPONENT OF POSITION VECTOR, IGM COORDINATE SYSTEM (RADIAL)	M
085 GAMI	TRAJ	INERTIAL FLIGHT PATH ANGLE (+ UP FROM LOCAL HORIZONTAL)	DEG
086 GAMR	TRAJ	RELATIVE FLIGHT PATH ANGLE (+ UP FROM LOCAL HORIZONTAL	DEG
236 GAMT	IGM	DESIRED ORBITAL INSERTION INERTIAL FLIGHT PATH ANGLE (+ UP FROM LOCAL HORIZONTAL)	DEG
230 GRAVT	IGM	THEORETICAL VALUE OF GRAVITY AT DESIRED ORBITAL INSERTION RADIUS	M/S2
208 GX13	POST	X-COMPONENT OF GRAVITY, APOLLO 13 SYSTEM	M/S2
041 GXP	TRAJ	X-COMPONENT OF GRAVITY, INERTIAL PLUMBLINE SYSTEM	M/S2

DEFINITIONS OF POSTPROCESSOR OUTPUT MNEMONICS (CONTINUED)

209 GY13	POST	Y-COMPONENT OF GRAVITY, APOLLO 13 SYSTEM	M/S2
042 GYP	TRAJ	Y-COMPONENT OF GRAVITY, INERTIAL PLUMBLINE SYSTEM	M/S2
210 GZ13	POST	Z-COMPONENT OF GRAVITY, APOLLO 13 SYSTEM	M/S2
043 GZP	TRAJ	Z-COMPONENT OF GRAVITY, INERTIAL PLUMBLINE SYSTEM	M/S2
178 HAE	CONIC	APOGEE ALTITUDE OF ELLIPTIC ORBIT	M
177 HPE	CONIC	PERIGEE ALTITUDE OF ELLIPTIC ORBIT	M
078 HSV	TRAJ	SUB-VEHICLE POINT ALTITUDE	M
226 IDLIMP	VLOSS	ACCUMULATED IDEAL IMPULSE REFERENCED INITIAL TIME	KG-S
099 INC	TRAJ	ORBIT INCLINATION ANGLE	DEG
157 ISCK	1-COV	FIRST INTEGRAL OF EULER-LAGRANGIAN EQUATION	M/S2
	2-HDWRE	HARDWARE ERROR INERTIAL VELOCITY	M/S
014 ISP	TRAJ	VACUUM SPECIFIC IMPULSE	SEC
141 K1	IGM	PORTION OF IGM PITCH ATTITUDE ANGLE REQUIRED TO SATISFY TERMINAL POSITION VECTOR (+ DOWN FROM ORBITAL INSERTION HORIZONTAL PLANE TO PROJECTION OF VEHICLE XM AXIS INTO ORBIT PLANE)	DEG
142 K2	IGM	TIME RATE OF CHANGE OF IGM PITCH ATTITUDE ANGLE REQUIRED TO SATISFY TERMINAL POSITION VECTOR (+ UP RATE)	DEG
143 K3	IGM	PORTION OF IGM YAW ATTITUDE ANGLE REQUIRED TO SATISFY TERMINAL POSITION VECTOR (+ LEFT FROM ORBIT PLANE TO VEHICLE XM AXIS)	DEG
144 K4	IGM	TIME RATE OF CHANGE OF IGM YAW ATTITUDE ANGLE REQUIRED TO SATISFY TERMINAL POSITION VECTOR (+ RIGHT RATE)	DEG
211 L113	POST	DIRECTION COSINE OF VEHICLE LONGITUDINAL AXIS IN THE APOLLO 13 X DIRECTION	-
072 L1P	TRAJ	DIRECTION COSINE OF VEHICLE LONGITUDINAL AXIS IN THE INERTIAL PLUMBLINE X DIRECTION	-
212 L213	POST	DIRECTION COSINE OF VEHICLE LONGITUDINAL AXIS IN THE APOLLO 13 Y DIRECTION	-

DEFINITIONS OF POSTPROCESSOR OUTPUT MNEMONICS (CONTINUED)

LOC	SYMBOL	MODULE	DESCRIPTION	UNITS
073	L2P	TRAJ	DIRECTION COSINE OF VEHICLE LONGITUDINAL AXIS IN THE INERTIAL PLUMB-LINE Y DIRECTION	-
213	L313	POST	DIRECTION COSINE OF VEHICLE LONGITUDINAL AXIS IN THE APOLLO 13 Z DIRECTION	-
074	L3P	TRAJ	DIRECTION COSINE OF VEHICLE LONGITUDINAL AXIS IN THE INERTIAL PLUMB-LINE Z DIRECTION	-
081	LAMDA	TRAJ	LONGITUDE REFERENCED TO EARTH-FIXED GREENWICH (+ WEST)	DEG
080	LAMDAI	TRAJ	LONGITUDE REFERENCED TO SPACE-FIXED GREENWICH (+ WEST)	DEG
079	LAMDAL	TRAJ	LONGITUDE OF THE LAUNCH SITE REFERENCED TO EARTH-FIXED GREENWICH (+ WEST)	DEG
010	MACH	TRAJ	MACH NUMBER	-
006	MASS	TRAJ	VEHICLE MASS	KG-S2/M
077	MU	TRAJ	VEHICLE ATTITUDE FROM LOCAL HORIZONTAL (+ NOSE UP)	DEG
018	PA	TRAJ	ATMOSPHERIC PRESSURE	KG/M2
084	PHI	TRAJ	GEODETIC LATITUDE OF RADIUS VECTOR (+ NORTH)	DEG
104	PHII	IGM	IGM RANGE ANGLE MEASURED IN ORBIT PLANE FROM DESCENDING NODE TO PROJECTION OF RADIUS VECTOR INTO ORBIT PLANE (+ IN DIRECTION OF MOTION)	DEG
082	PHIL	TRAJ	GEODETIC LATITUDE OF THE LAUNCH SITE (+ NORTH)	DEG
083	PHIPR	TRAJ	GEOCENTRIC LATITUDE (DECLINATION) OF RADIUS VECTOR (+ NORTH)	DEG
111	PHIPSV	TRAJ	GEOCENTRIC LATITUDE OF SUB-VEHICLE POINT (+ NORTH)	DEG
160	PHIPT	IMPACT	GEOCENTRIC LATITUDE OF IMPACT POINT (+ NORTH)	DEG
110	PHISV	TRAJ	GEODETIC LATITUDE OF SUB-VEHICLE POINT (+ NORTH)	DEG
158	PHIT	IMPACT	GEODETIC LATITUDE OF IMPACT POINT (+ NORTH)	DEG

DEFINITIONS OF POSTPROCESSOR OUTPUT MNEMONICS (CONTINUED)

LOC SYMBOL	MODULE	DESCRIPTION	UNITS
103 PHT	IGM	TOTAL IGM RANGE ANGLE MEASURED IN ORBIT PLANE FROM DESCENDING MODE TO PREDICTED ORBIT INJECTION POINT (+ IN DIRECTION OF MOTION)	DEG
107 PRNG	TRAJ	INERTIAL RANGE ANGLE FROM LAUNCH SITE	DEG
108 PRNGE	TRAJ	EARTH-FIXED RANGE ANGLE FROM LAUNCH SITE	DEG
021 Q	TRAJ	DYNAMIC PRESSURE	KG/M2
075 QALPHA	TRAJ	PRODUCT OF DYNAMIC PRESSURE AND TOTAL ANGLE OF ATTACK	DEG-KG/M2
167 RAE	CONIC	APOGEE RADIUS OF ELLIPTIC ORBIT	M
233 RAPØG	IGM	APOGEE RADIUS OF DESIRED ORBIT -- AVAILABLE ONLY WITH IGM OPTION IORBIT=3	M
025 REØ	TRAJ	EARTH RADIUS AT INITIAL TIME	M
020 RHØ	TRAJ	ATMOSPHERIC DENSITY	KG-S2/M4
159 RLAMT	IMPACT	LONGITUDE OF IMPACT POINT REFER-ENCED TO EARTH-FIXED GREENWICH (+ WEST)	DEG
005 RI	TRAJ	RADIUS TO VEHICLE	M
009 RIE	TRAJ	EARTH RADIUS	M
026 RNG	TRAJ	INERTIAL GROUND RANGE FROM LAUNCH SITE	M
027 RNGE	TRAJ	EARTH-FIXED GROUND RANGE FROM LAUNCH SITE	M
024 RØ	TRAJ	RADIUS TO VEHICLE AT INITIAL TIME	M
166 RP	CONIC	PERIGEE RADIUS	M
228 RT	IGM	DESIRED ORBITAL INSERTION RADIUS	M
165 SREC	CONIC	SEMI-LATUS RECTUM	M
232 SRECP	IGM	SEMI-LATUS RECTUM OF DESIRED ORBIT-- AVAILABLE ONLY WITH IGM OPTION IORBIT=3	M
145 T1	IGM	BURN TIME REMAINING OF FIRST IGM PHASE FOR THE THREE PHASE IGM SCHEME	SEC
146 T2	IGM	A) BURN TIME REMAINING OF SECOND IGM PHASE FOR THE THREE PHASE IGM SCHEME	SEC
		B) BURN TIME REMAINING OF FIRST IGM PHASE FOR THE TWO PHASE IGM SCHEME	SEC

DEFINITIONS OF POSTPROCESSOR OUTPUT MNEMONICS (CONTINUED)

LOC	SYMBOL	MODULE	DESCRIPTION	UNITS
147	T3	IGM	PREDICTED BURN TIME OF THE LAST IGM PHASE	SEC
235	TANØM	IGM	TRUE ANOMALY OF DESIRED ORBITAL INSERTION (+ IN DIRECTION OF MOTION) -- AVAILABLE ONLY WITH IGM OPTION IORBIT=3	DEG
179	TAØE	CONIC	TIME FROM LIFTOFF TO FIRST APOGEE OF ELLIPTIC ORBIT	SEC
148	TAU1	IGM	RATIO OF NOMINAL ENGINE EXHAUST VELOCITY OF FIRST IGM PHASE OF THE THREE PHASE IGM SCHEME TO MAGNITUDE OF ACCELEROMETER-SENSED ACCELERATION	SEC
149	TAU2	IGM	A) DURING FIRST IGM PHASE OF THE THREE PHASE IGM SCHEME, PREDICTED RATIO OF NOMINAL WEIGHT TO NOMINAL WEIGHT FLOW RATE AT BEGINNING OF SECOND IGM PHASE	SEC
			B) DURING SECOND IGM PHASE OF THE THREE PHASE IGM SCHEME, RATIO OF NOMINAL ENGINE EXHAUST VELOCITY OF THE SECOND IGM PHASE TO MAGNITUDE OF ACCELEROMETER-SENSED ACCELERATION	SEC
			C) DURING FIRST IGM PHASE OF THE TWO PHASE IGM SCHEME, RATIO OF NOMINAL ENGINE EXHAUST VELOCITY OF THE FIRST IGM PHASE TO MAGNITUDE OF ACCELEROMETER-SENSED ACCELERATION	
150	TAU3	IGM	A) PRIOR TO BEGINNING OF LAST IGM PHASE, PREDICTED RATIO OF NOMINAL WEIGHT TO NOMINAL WEIGHT FLOW RATE AT BEGINNING OF LAST IGM PHASE	SEC
			B) DURING LAST IGM PHASE, RATIO OF NOMINAL ENGINE EXHAUST VELOCITY OF LAST IGM PHASE TO MAGNITUDE OF ACCELEROMETER-SENSED ACCELERATION	SEC
170	TAUE	CONIC	ELLIPTIC ORBIT PERIOD	SEC
019	TEMP	TRAJ	ATMOSPHERIC TEMPERATURE	DEG-K
161	TFLHT	IMPACT	TIME FROM LIFTOFF TO IMPACT POINT	SEC
214	TGUTDE	IGM	TIME IGM PARAMETERS ARE UPDATED	SEC
102	THN	TRAJ	ORBIT DESCENDING NODE, MEASURED FROM INERTIAL LAUNCH MERIDIAN (+ EAST)	DEG
008	THRUST	TRAJ	RESULTANT THRUST	KG

DEFINITIONS OF POSTPROCESSOR OUTPUT MNEMONICS (CONTINUED)

LOC	SYMBOL	MODULE	DESCRIPTION	UNITS
002	TIME	TRAJ	FLIGHT TIME	SEC
135	TL1	1-COV	LAGRANGIAN MULTIPLIER (LAMD1)	-
		2-HDWRE	X-COMPONENT OF HARDWARE ERROR POSITION VECTOR, HARDWARE ERROR INERTIAL PLUMB-LINE SYSTEM	M
136	TL2	1-COV	LAGRANGIAN MULTIPLIER (LAMD2)	-
		2-HDWRE	Y-COMPONENT OF HARDWARE ERROR POSITION VECTOR, HARDWARE ERROR INERTIAL PLUMBLINE SYSTEM	M
137	TL3	1-COV	LAGRANGIAN MULTIPLIER (LAMD3)	-
		2-HDWRE	Z-COMPONENT OF HARDWARE ERROR POSITION VECTOR, HARDWARE ERROR INERTIAL PLUMBLINE SYSTEM	M
131	TL7	1-COV	LAGRANGIAN MULTIPLIER ASSOCIATED WITH THE MASS FLOW	M2/KG-S3
		2-HDWRE	HARDWARE ERROR ORBIT DESCENDING NODE	DEG
125	TLD1	1-COV	FIRST TIME DERIVATIVE OF THE LAGRANGIAN MULTIPLIER LAMD1	-/S
		2-HDWRE	X-COMPONENT OF HARDWARE ERROR INERTIAL VELOCITY VECTOR, HARDWARE ERROR INERTIAL PLUMBLINE SYSTEM	M/S
126	TLD2	1-COV	FIRST TIME DERIVATIVE OF THE LAGRANGIAN MULTIPLIER LAMD2	-/S
		2-HDWRE	Y-COMPONENT OF HARDWARE ERROR INERTIAL VELOCITY VECTOR, HARDWARE ERROR INERTIAL PLUMBLINE SYSTEM	M/S
127	TLD3	1-COV	FIRST TIME DERIVATIVE OF THE LAGRANGIAN MULTIPLIER LAMD3	-/S
		2-HDWRE	Z-COMPONENT OF HARDWARE ERROR INERTIAL VELOCITY VECTOR, HARDWARE ERROR INERTIAL PLUMBLINE SYSTEM	M/S
121	TLD7	1-COV	FIRST TIME DERIVATIVE OF THE LAGRANGIAN MULTIPLIER ASSOCIATED WITH THE MASS FLOW	M2/KG-S4
		2-HDWRE	HARDWARE ERROR RADIUS TO VEHICLE	M
115	TLDD1	1-COV	SECOND TIME DERIVATIVE OF THE LAGRANGIAN MULTIPLIER LAMD1	-/S2
		2-HDWRE	X-COMPONENT OF HARDWARE ERROR INERTIAL ACCELERATION VECTOR, HARDWARE ERROR INERTIAL PLUMBLINE SYSTEM	M/S2

DEFINITIONS OF POSTPROCESSOR OUTPUT MNEMONICS (CONTINUED)

LOC	SYMBOL	MODULE	DESCRIPTION	UNITS
116	TLDD2	1-COV	SECOND TIME DERIVATIVE OF THE LAGRANGIAN MULTIPLIER LAMD2	-/S2
		2-HDWRE	Y-COMPONENT OF HARDWARE ERROR INERTIAL ACCELERATION VECTOR, HARD-WARE ERROR INERTIAL PLUMBLINE SYSTEM	M/S2
117	TLDD3	1-COV	SECOND TIME DERIVATIVE OF THE LAGRANGIAN MULTIPLIER LAMD3	-/S2
		2-HDWRE	Z-COMPONENT OF HARDWARE ERROR INERTIAL ACCELERATION VECTOR, HARD-WARE ERROR INERTIAL PLUMBLINE SYSTEM	M/S2
173	TNØM	CONIC	TRUE ANOMALY (+ IN DIRECTION OF MOTION)	DEG
162	TØTAE	TRAJ	TOTAL NOZZLE AREA OF BURNING ENGINES	M2
174	TPØE	CONIC	TIME FROM PERIGEE OF ELLIPTIC ORBIT	SEC
176	TPØH	CONIC	TIME FROM PERIGEE OF HYPERBOLIC ORBIT	SEC
175	TPØP	CONIC	TIME FROM PERIGEE OF PARABOLIC ORBIT	SEC
076	TVAC	TRAJ	TOTAL SCALAR VACUUM THRUST	KG
035	TX	TRAJ	X-COMPONENT OF RESULTANT THRUST VECTOR, MISSILE SYSTEM (AXIAL THRUST)	KG
205	TX13	POST	X-COMPONENT OF RESULTANT THRUST VECTOR, APOLLO 13 SYSTEM	KG
038	TXP	TRAJ	X-COMPONENT OF RESULTANT THRUST VECTOR, INERTIAL PLUMBLINE SYSTEM	KG
036	TY	TRAJ	Y-COMPONENT OF RESULTANT THRUST VECTOR, MISSILE SYSTEM (SIDE THRUST)	KG
206	TY13	POST	Y-COMPONENT OF RESULTANT THRUST VECTOR, APOLLO 13 SYSTEM	KG
039	TYP	TRAJ	Y-COMPONENT OF RESULTANT THRUST VECTOR, INERTIAL PLUMBLINE SYSTEM	KG
037	TZ	TPAJ	Z-COMPONENT OF RESULTANT THRUST VECTOR, MISSILE SYSTEM (NORMAL THRUST)	KG
207	TZ13	POST	Z-COMPONENT OF RESULTANT THRUST VECTOR, APOLLO 13 SYSTEM	KG
040	TZP	TRAJ	Z-COMPONENT OF RESULTANT THRUST VECTOR, INERTIAL PLUMBLINE SYSTEM	KG
172	VAE	CONIC	APOGEE VELOCITY OF ELLIPTIC ORBIT	M/S
071	VE	TRAJ	EARTH-FIXED VELOCITY	M/S
004	VI	TRAJ	INERTIAL VELOCITY	M/S

DEFINITIONS OF POSTPROCESSOR OUTPUT MNEMONICS (CONTINUED)

LOC	SYMBOL	MODULE	DESCRIPTION	UNITS
223	VLAI	VLOSS	ACCUMULATED INERTIAL VELOCITY LOSS DUE TO AERODYNAMICS REFERENCED TO INITIAL TIME	M/S
224	VLAR	VLOSS	ACCUMULATED RELATIVE VELOCITY LOSS DUE TO AERODYNAMICS REFERENCED TO INITIAL TIME	M/S
225	VLAT	VLOSS	ACCUMULATED INERTIAL (OR RELATIVE) VELOCITY LOSS DUE TO ATMOSPHERIC CORRECTION OF VACUUM THRUST REFERENCED TO INITIAL TIME	M/S
219	VLGI	VLOSS	ACCUMULATED INERTIAL VELOCITY LOSS DUE TO GRAVITY REFERENCED TO INITIAL TIME	M/S
220	VLGR	VLOSS	ACCUMULATED RELATIVE VELOCITY LOSS DUE TO GRAVITY REFERENCED TO INITIAL TIME	M/S
221	VLTVI	VLOSS	ACCUMULATED INERTIAL VELOCITY LOSS DUE TO THRUST VECTORING REFERENCED TO INITIAL TIME	M/S
222	VLTVR	VLOSS	ACCUMULATED RELATIVE VELOCITY LOSS DUE TO THRUST VECTORING REFERENCED TO INITIAL TIME	M/S
171	VP	CONIC	PERIGEE VELOCITY	M/S
011	VR	TRAJ	RELATIVE VELOCITY - VELOCITY OF THE VEHICLE RELATIVE TO THE SURROUNDING ATMOSPHERE	M/S
012	VS	TRAJ	VELOCITY OF SOUND	M/S
218	VSTAR	VLOSS	ACCUMULATED IDEAL VELOCITY REFERENCED TO INITIAL TIME	M/S
229	VT	IGM	DESIRED ORBITAL INSERTION INERTIAL VELOCITY	M/S
017	VW	TRAJ	WIND VELOCITY	M/S
007	WEIGHT	TRAJ	VEHICLE WEIGHT,	KG
013	WDØT	TRAJ	VEHICLE WEIGHT FLOW RATE	KG/S
215	X10	POST	X-COMPONENT OF POSITION VECTOR, APOLLO 10 SYSTEM	M
184	X11	POST	X-COMPONENT OF POSITION VECTOR, APOLLO 11 SYSTEM	M
193	X13	POST	X-COMPONENT OF POSITION VECTOR, APOLLO 13 SYSTEM	M

DEFINITIONS OF POSTPROCESSOR OUTPUT MNEMONICS (CONTINUED)

LOC SYMBOL	MODULE	DESCRIPTION	UNITS
105 XBARP	IGM	PORTION OF IGM PITCH ATTITUDE ANGLE REQUIRED TO SATISFY TERMINAL VELOCITY VECTOR (+ UP FROM ORBITAL INSERTION HORIZONTAL PLANE TO PROJECTION OF VEHICLE XM AXIS INTO ORBIT PLANE)	DEG
106 XBARY	IGM	PORTION OF IGM YAW ATTITUDE ANGLE REQUIRED TO SATISFY TERMINAL VELOCITY VECTOR (+ RIGHT FROM ORBIT PLANE TO VEHICLE XM AXIS)	DEG
187 XD11	POST	X-COMPONENT OF EARTH-FIXED VELOCITY VECTOR, APOLLO 10 AND 11 SYSTEMS	M/S
196 XD13	POST	X-COMPONENT OF INERTIAL VELOCITY VECTOR, APOLLO 13 SYSTEM	M/S
190 XDD11	POST	X-COMPONENT OF EARTH-FIXED ACCELERATION VECTOR, APOLLO 10 AND 11 SYSTEMS	M/S2
199 XDD13	POST	X-COMPONENT OF INERTIAL ACCELERATION VECTOR, APOLLO 13 SYSTEM	M/S2
068 XDDE	TRAJ	X-COMPONENT OF EARTH-FIXED ACCELERATION VECTOR, EARTH-FIXED EQUATORIAL SYSTEM	M/S2
050 XDDI	TRAJ	X-COMPONENT OF INERTIAL ACCELERATION VECTOR, INERTIAL EQUATORIAL SYSTEM	M/S2
118 XDDM	1-TRAJ	X-COMPONENT OF ACCELEROMETER-SENSED ACCELERATION, MISSILE SYSTEM (AXIAL)	M/S2
	2-HDWRE	TOTAL GYRO DRIFT RATE ABOUT XP YAW AXIS, HARDWARE ERROR INERTIAL PLUMB-LINE SYSTEM (+ RIGHT-HAND)	DEG/S
112 XDDP	TRAJ	X-COMPONENT OF INERTIAL ACCELERATION VECTOR, INERTIAL PLUMBLINE SYSTEM	M/S2
065 XDE	TRAJ	X-COMPONENT OF EARTH-FIXED VELOCITY VECTOR, EARTH-FIXED EQUATORIAL SYSTEM	M/S
047 XDI	TRAJ	X-COMPONENT OF INERTIAL VELOCITY VECTOR, INERTIAL EQUATORIAL SYSTEM	M/S
053 XDIW	TRAJ	X-COMPONENT OF INERTIAL WIND VELOCITY INCLUDING ROTATING ATMOSPHERE, INERTIAL EQUATORIAL SYSTEM	M/S
128 XDM	1-TRAJ	X-COMPONENT OF THE FIRST INTEGRAL OF ACCELEROMETER-SENSED ACCELERATION, MISSILE SYSTEM	M/S
	2-HDWRE	ANGULAR DISPLACEMENT OF GYRO PLATFORM FROM NULL ABOUT XP YAW AXIS, HARDWARE ERROR INERTIAL PLUMBLINE SYSTEM (+ RIGHT-HAND)	DEG

DEFINITIONS OF POSTPROCESSOR OUTPUT MNEMONICS (CONTINUED)

LOC SYMBOL	MODULE	DESCRIPTION	UNITS
122 XDP	TRAJ	X-COMPONENT OF INERTIAL VELOCITY VECTOR, INERTIAL PLUMBLINE SYSTEM	M/S
056 XDPR	TRAJ	X-COMPONENT OF RELATIVE VELOCITY VECTOR, INERTIAL PLUMBLINE SYSTEM	M/S
059 XDPW	TRAJ	X-COMPONENT OF INERTIAL WIND VELOCITY INCLUDING ROTATING ATMOSPHERE, INERTIAL PLUMBLINE SYSTEM	M/S
062 XE	TRAJ	X-COMPONENT OF POSITION VECTOR, EARTH-FIXED EQUATORIAL SYSTEM	M
044 XI	TRAJ	X-COMPONENT OF POSITION VECTOR, INERTIAL EQUATORIAL SYSTEM	M
138 XM	1-TRAJ	X-COMPONENT OF THE SECOND INTEGRAL OF ACCELEROMETER-SENSED ACCELERATION, MISSILE SYSTEM	M
	2-HDWRE	X-COMPONENT OF HARDWARE ERROR GRAVITY, HARDWARE ERROR INERTIAL PLUMBLINE SYSTEM	M/S2
132 XP	TRAJ	X-COMPONENT OF POSITION VECTOR, INERTIAL PLUMBLINE SYSTEM	M
151 XXI	IGM	X-COMPONENT OF POSITION VECTOR, IGM COORDINATE SYSTEM (DOWNRANGE)	M
216 Y10	POST	Y-COMPONENT OF POSITION VECTOR, APOLLO 10 SYSTEM	M
185 Y11	POST	Y-COMPONENT OF POSITION VECTOR, APOLLO 11 SYSTEM	M
194 Y13	POST	Y-COMPONENT OF POSITION VECTOR, APOLLO 13 SYSTEM	M
188 YD11	POST	Y-COMPONENT OF EARTH-FIXED VELOCITY VECTOR, APOLLO 10 AND 11 SYSTEMS	M/S
197 YD13	POST	Y-COMPONENT OF INERTIAL VELOCITY VECTOR, APOLLO 13 SYSTEM	M/S
191 YDD11	POST	Y-COMPONENT OF EARTH-FIXED ACCELERATION VECTOR, APOLLO 10 AND 11 SYSTEMS	M/S2
200 YDD13	POST	Y-COMPONENT OF INERTIAL ACCELERATION VECTOR, APOLLO 13 SYSTEM	M/S2
069 YDDE	TRAJ	Y-COMPONENT OF EARTH-FIXED ACCELERATION VECTOR, EARTH-FIXED EQUATORIAL SYSTEM	M/S2
051 YDDI	TRAJ	Y-COMPONENT OF INERTIAL ACCELERATION VECTOR, INERTIAL EQUATORIAL SYSTEM	M/S2

DEFINITIONS OF POSTPROCESSOR OUTPUT MNEMONICS (CONTINUED)

LOC	SYMBOL	MODULE	DESCRIPTION	UNITS
119	YDDM	1-TRAJ	Y-COMPONENT OF ACCELEROMETER-SENSED ACCELERATION, MISSILE SYSTEM (SIDE)	M/S2
		2-HDWRE	TOTAL GYRO DRIFT RATE ABOUT UP ROLL AXIS, HARDWARE ERROR INERTIAL PLUMPLINE SYSTEM (+ RIGHT-HAND)	DEG/S
113	YDDP	TRAJ	Y-COMPONENT OF INERTIAL ACCELERATION VECTOR, INERTIAL PLUMBLINE SYSTEM	M/S2
066	YDE	TRAJ	Y-COMPONENT OF EARTH-FIXED VELOCITY VECTOR, EARTH-FIXED EQUATORIAL SYSTEM	M/S
048	YDI	TRAJ	Y-COMPONENT OF INERTIAL VELOCITY VECTOR, INERTIAL EQUATORIAL SYSTEM	M/S
054	YDIW	TRAJ	Y-COMPONENT OF INERTIAL WIND VELOCITY INCLUDING ROTATING ATMOSPHERE, INERTIAL EQUATORIAL SYSTEM	M/S
129	YDM	1-TRAJ	Y-COMPONENT OF THE FIRST INTEGRAL OF ACCELEROMETER-SENSED ACCELERATION, MISSILE SYSTEM	M/S
		2-HDWRE	ANGULAR DISPLACEMENT OF GYRO PLATFORM FROM NULL ABOUT YP ROLL AXIS, HARDWARE ERROR INERTIAL PLUMBLINE SYSTEM (+ RIGHT-HAND)	DEG
123	YDP	TRAJ	Y-COMPONENT OF INERTIAL VELOCITY VECTOR, INERTIAL PLUMBLINE SYSTEM	M/S
057	YDPR	TRAJ	Y-COMPONENT OF RELATIVE VELOCITY VECTOR, INERTIAL PLUMBLINE SYSTEM	M/S
060	YDPW	TRAJ	Y-COMPONENT OF INERTIAL WIND VELOCITY INCLUDING ROTATING ATMOSPHERE, INERTIAL PLUMBLINE SYSTEM	M/S
063	YE	TRAJ	Y-COMPONENT OF POSITION VECTOR, EARTH-FIXED EQUATORIAL SYSTEM	M
045	YI	TRAJ	Y-COMPONENT OF POSITION VECTOR, INERTIAL EQUATORIAL SYSTEM	M
139	YM	1-TRAJ	Y-COMPONENT OF THE SECOND INTEGRAL OF ACCELEROMETER-SENSED ACCELERATION, MISSILE SYSTEM	M
		2-HDWRE	Y-COMPONENT OF HARDWARE ERROR GRAVITY, HARDWARE ERROR INERTIAL PLUMBLINE SYSTEM	M/S2
133	YP	TRAJ	Y-COMPONENT OF POSITION VECTOR, INERTIAL PLUMBLINE SYSTEM	M

DEFINITIONS OF POSTPROCESSOR OUTPUT MNEMONICS (CONTINUED)

LOC	SYMBOL	MODULE	DESCRIPTION	UNITS
217	Z10	POST	Z-COMPONENT OF POSITION VECTOR, APOLLO 10 SYSTEM	M
186	Z11	POST	Z-COMPONENT OF POSITION VECTOR, APOLLO 11 SYSTEM	M
195	Z13	POST	Z-COMPONENT OF POSITION VECTOR, APOLLO 13 SYSTEM	M
189	ZD11	POST	Z-COMPONENT OF EARTH-FIXED VELOCITY VECTOR, APOLLO 10 AND 11 SYSTEMS	M/S
198	ZD13	POST	Z-COMPONENT OF INERTIAL VELOCITY VECTOR, APOLLO 13 SYSTEM	M/S
192	ZDD11	POST	Z-COMPONENT OF EARTH-FIXED ACCELERATION VECTOR, APOLLO 10 AND 11 SYSTEMS	M/S2
201	ZDD13	POST	Z-COMPONENT OF INERTIAL ACCELERATION VECTOR, APOLLO 13 SYSTEM	M/S2
070	ZDDE	TRAJ	Z-COMPONENT OF EARTH-FIXED ACCELERATION VECTOR, EARTH-FIXED EQUATORIAL SYSTEM	M/S2
052	ZDDI	TRAJ	Z-COMPONENT OF INERTIAL ACCELERATION VECTOR, INERTIAL EQUATORIAL SYSTEM	M/S2
120	ZDDM	1-TRAJ	Z-COMPONENT OF ACCELEROMETER-SENSED ACCELERATION, MISSILE SYSTEM (NORMAL)	M/S2
		2-HDWRE	TOTAL GYRO DRIFT RATE ABOUT ZP PITCH AXIS, HARDWARE ERROR INERTIAL PLUMBLINE SYSTEM (+ RIGHT-HAND)	DEG/S
114	ZDDP	TRAJ	Z-COMPONENT OF INERTIAL ACCELERATION VECTOR, INERTIAL PLUMBLINE SYSTEM	M/S2
067	ZDE	TRAJ	Z-COMPONENT OF EARTH-FIXED VELOCITY VECTOR, EARTH-FIXED EQUATORIAL SYSTEM	M/S
049	ZDI	TRAJ	Z-COMPONENT OF INERTIAL VELOCITY VECTOR, INERTIAL EQUATORIAL SYSTEM	M/S
055	ZDIW	TRAJ	Z-COMPONENT OF INERTIAL WIND VELOCITY INCLUDING ROTATING ATMOSPHERE, INERTIAL EQUATORIAL SYSTEM	M/S
130	ZDM	1-TRAJ	Z-COMPONENT OF THE FIRST INTEGRAL OF ACCELEROMETER-SENSED ACCELERATION	M/S
		2-HDWRE	ANGULAR DISPLACEMENT OF GYRO PLATFORM FROM NULL ABOUT ZP PITCH AXIS, HARDWARE ERROR INERTIAL PLUMBLINE SYSTEM (+ RIGHT-HAND)	DEG

DEFINITIONS OF POSTPROCESSOR OUTPUT MNEMONICS (CONTINUED)

LOC	SYMBOL	MODULE	DESCRIPTION	UNITS
124	ZDP	TRAJ	Z-COMPONENT OF INERTIAL VELOCITY VECTOR, INERTIAL PLUMBLINE SYSTEM	M/S
058	ZDPR	TRAJ	Z-COMPONENT OF RELATIVE VELOCITY VECTOR, INERTIAL PLUMBLINE SYSTEM	M/S
061	ZDPW	TRAJ	Z-COMPONENT OF INERTIAL WIND VELOCITY INCLUDING ROTATING ATMOSPHERE, INERTIAL PLUMBLINE SYSTEM	M/S
064	ZE	TRAJ	Z-COMPONENT OF POSITION VECTOR, EARTH-FIXED EQUATORIAL SYSTEM	M
153	ZETA	IGM	Z-COMPONENT OF POSITION VECTOR, IGM COORDINATE SYSTEM (CROSS RANGE)	M
046	ZI	TRAJ	Z-COMPONENT OF POSITION VECTOR, INERTIAL EQUATORIAL SYSTEM	M
140	ZM	1-TRAJ	Z-COMPONENT OF THE SECOND INTEGRAL OF ACCELEROMETER-SENSED ACCELERATION, MISSILE SYSTEM	M
		2-HDWRE	Z-COMPONENT OF HARDWARE ERROR GRAVITY, HARDWARE ERROR INERTIAL PLUMBLINE SYSTEM	M/S2
134	ZP	TRAJ	Z-COMPONENT OF POSITION VECTOR, INERTIAL PLUMBLINE SYSTEM	M

APPENDIX C

PLOTTING TAPE FORMAT

If KKK input to PNCH08 is set to 1 or 2, the contents of the data words extracted from the MSFC trajectory tape are written on the tape unit specified by IOUNIT If an assign card for this unit is not included, the information is written on the drum. If the unit is assigned to FASTRAND, the data are available for plotting in the following execution. If the unit is assigned to tape, the data can be saved for plotting at a later time.

The data are written in a format acceptable by TRWPLT, a generalized plot program. The first and last words of each record are the usual FORTRAN green words, and the next to last word is the record check sum Since these words are not seen by the user, they will be ignored in further discussions of the tape format

The first two records contain the names of the output data. The following records contain the data words, one record for each time point. The first word of these records is an integer 1. When the time equals an integral multiple of the input TIMTIC, the record is also written with the first word as an integer 2. The specific format of each record is shown on the following page

Word	1st Record	2nd Record	Data Record	Time Tick Record
1	-1	-2	1	2
2	NAM(1)	NAM(1)	N(1)	N(1)
3	NAM(2)	NAM(2)	N(2)	N(2)
.	.	.	.	.
.	.	.	.	
.	.		.	.
.	.	.	.	.
101*	NAM(100)	NAM(100)	N(100)	N(100)
102**	WTFL	WTFL	Value of WTFL	Value of WTFL
103	TFF3	TFF3	Value of TFF3	Value of TFF3
104	HDOT	HDOT	Value of HDOT	Value of HDOT
105	VEI3	VEI3	Value of VEI3	Value of VEI3
106	GEI3	GEI3	Value of GEI3	Value of GEI3
107	CRNG	CRNG	Value of CRNG	Value of CRNG
108	RAPO	RAPO	Value of RAPO	Value of RAPO
109	RPER	RPER	Value of RPER	Value of RPER
110	WEDG	WEDG	Value of WEDG	Value of WEDG

When different plot tapes are combined with the MERGE processor, different record tapes are assigned Table C-1 illustrates the plot tape format.

*This would represent the maximum number of variables. If less variables were specified, the following number of words would be reduced accordingly.

**These parameters are output if the special parameter computation is requested.

Table C-1. MERGE Plot Tape Format

WORD	MAXIMUM NUMBER OF VARIABLES THAT CAN BE SPECIFIED				THESE PARAMETERS ARE OUTPUT IF THE SPECIAL PARAMETER COMPUTATION IS REQUESTED DURING THE PNCH08 RUN								
	1	2	3	101	102	103	104	105	106	107	108	109	110
1ST NEGATIVE RECORD TYPE	-1	NAM(1)	NAM(2)	NAM(100)	NAM(101)	NAM(102)	NAM(103)	NAM(104)	NAM(105)	NAM(106)	NAM(107)	NAM(108)	NAM(109)
2ND	-2	NAM(1)	NAM(2)	NAM(100)	NAM(101)	NAM(102)	NAM(103)	NAM(104)	NAM(105)	NAM(106)	NAM(107)	NAM(108)	NAM(109)
3RD	-3	NAM(1)	NAM(2)	NAM(100)	NAM(101)	NAM(102)	NAM(103)	NAM(104)	NAM(105)	NAM(106)	NAM(107)	NAM(108)	NAM(109)
NTH	NTH	NAM(1)	NAM(2)	NAM(100)	NAM(101)	NAM(102)	NAM(103)	NAM(104)	NAM(105)	NAM(106)	NAM(107)	NAM(108)	NAM(109)
1ST POSITIVE RECORD TYPE	1	N(1)	N(2)	N(100)	WTFL	TFF3	HDOT	VEI3	GEI3	CRNG	RAPO	RPER	WEDG
	1	N(1)	N(2)	N(100)	WTFL	TFF3	HDOT	VEI3	GEI3	CRNG	RAPO	RPER	WEDG
MTH RECORD OF 1ST POSITIVE RECORD TYPE	1	N(1)	N(2)	N(100)	WTFL	TFF3	HDOT	VEI3	GEI3	CRNG	RAPO	RPER	WEDG
2ND POSITIVE RECORD TYPE	2	N(1)	N(2)	N(100)	WTFL	TFF3	HDOT	VEI3	GEI3	CRNG	RAPO	RPER	WEDG
	2	N(1)	N(2)	N(100)	WTFL	TFF3	HDOT	VEI3	GEI3	CRNG	RAPO	RPER	WEDG
MTH RECORD OF 2ND POSITIVE RECORD TYPE	2	N(1)	N(2)	N(100)	WTFL	TFF3	HDOT	VEI3	GEI3	CRNG	RAPO	RPER	WEDG
3RD POSITIVE RECORD TYPE	3	N(1)	N(2)	N(100)	WTFL	TFF3	HDOT	VEI3	GEI3	CRNG	RAPO	RPER	WEDG
	3	N(1)	N(2)	N(100)	WTFL	TFF3	HDOT	VEI3	GEI3	CRNG	RAPO	RPER	WEDG
MTH RECORD OF 3RD POSITIVE RECORD TYPE	3	N(1)	N(2)	N(100)	WTFL	TFF3	HDOT	VEI3	GEI3	CRNG	RAPO	RPER	WEDG
NTH POSITIVE RECORD TYPE	NTH	N(1)	N(2)	N(100)	WTFL	TFF3	HDOT	VEI3	GEI3	CRNG	RAPO	RPER	WEDG
	NTH	N(1)	N(2)	N(100)	WTFL	TFF3	HDOT	VEI3	GEI3	CRNG	RAPO	RPER	WEDG
MTH RECORD OF NTH POSITIVE RECORD TYPE	NTH	N(1)	N(2)	N(100)	WTFL	TFF3	HDOT	VEI3	GEI3	CRNG	RAPO	RPER	WEDG

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